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## THE WATERPOWER PROBLEM.

One of the most engrossing topics that has aroused public attention during the year now rapidly drawing to a close is the development of our western water powers. The public press has been filled with a multitude of conflicting views on the subject and a number of our otherwise extremely judicious public officials have taken an exaggerated view of the problem.

In as much as the electrical fraternity is largely involved in the development of water powers, it was most fitting that the American Institute of Electrical Engineers should have lent its influence to educating the public to the true status of the problem and to a more considerate attitude toward those who are trying to place the waterpower resources of the country at the disposal of the public. There could not have been a more happy selection than that of Mr. Henry L. Doherty, who is at the same time both a capable engineer and financier, to present a concise and yet comprehensive summary of the difficulties attending the development and operation of hydroelectric plants.

Mr. Doherty's paper, an abstract of which with the discussion on it is given on other pages of this issue, is a series of pithy and pertinent comments on various aspects of the problem. The paper as a whole must be read several times and studied in great detail in order to discover the full significance of the numerous points raised. Only a few of his comments will receive mention here.

One of the important features brought out is the great need of a steam-driven plant as an adjunct of any hydroelectric development that aims to make the most of the opportunities at hand. A good example of the value of such a plant is that of the Michigan Power Company at Lansing, Mich., a description of whose system is given in another part of this issue. Here the steam plant was used to supply the needs of the rapidly growing power market until the first hydroelectric development was completed and ready to run at substantially full load. The steam plant serves to carry peak loads throughout the year, especially the heavier winter load, and to supply central-station steam heating. It will also carry an increasing part of the load due to the expansion of the market beyond the capacity of the hydroelectric plant until the development of another such plant is justified. Mr. Doherty even suggests the advisability of even running the auxiliary steam plant merely as

a reserve to insure reliability of service from the system, and he proposes the running of steam turbo-generators as synchronous motors, ready, at a slight drop in voltage or frequency, to open the steam valves of the turbine so as to pick up the load as a generator. This plan, with Mr. Doherty's scheme of penalties for interruption in the service, indicates that he protests too strongly concerning the unreliability of transmission lines; on the other hand, it must be remembered that he looks on this feature from his standard of reliable service, which is extremely high.

Another important aspect of the problem is its relation to the public. The general belief that waterpower projects net thirty to forty per cent on the investment is based on the distorted prospectuses of several unscrupulous promoters. Actually about three per cent seems to be the average return, and there are altogether too many hydroelectric companies in the hands of receivers. It is unfortunate that the former erroneous figures should have been impressed on government officials so strongly and have inspired them to throw hindrances in the way of development of the numerous water powers in our great West. It is to be hoped that the American Institute of Electrical Engineers' discussion of last week will have some influence with them in pointing out the numerous difficulties there are in the way of making any hydroelectric project a reasonably attractive investment and to show the importance of wisely developing the waterpower resources of the West as a most judicious way to conserve its fuel resources.

## COST OF POWER PRODUCTION IN TWO CENTRAL STATIONS.

Opponents of the centralized management of public utility corporations are fond of citing figures showing wide differences in the operating results of plants under the same control. They enjoy pointing out that the size of the organization does not necessarily determine the degree of operating economy attainable. The small plant of moderate means sometimes surpasses its more costly neighbor in efficiency, and again, the station run by purely local engineering skill not seldom generates power at a lower cost than a plant of about the same size which happens to be operated by a large syndicate. Such are the arguments on behalf of individualized operation, so far as they deal with the broad subject of manufacturing costs. Doubtless it is true that the effect of local conditions is in the main more important in the records of a central station than the location of its management, and yet striking similarities in practice and results now and then come to hand from plants under the same general control and handled in accordance with a well-fixed policy.

The past year's station records from two such plants are interesting on account of their similarity. Both installations are located in the same state, and are handled by local managers responsible to the main office of the controlling syndicate. The methods of administration are the same in each case, and the engineering problems of each company are under the jurisdiction of the home office staff. One station had an average normal capacity during the year of 3,650 kilowatts, and the other was rated at 2,000 kilowatts. The first and larger plant was equipped with four water-tube boilers having an aggregate rating of 1,910 horsepower; it had three compound condensing engines of about 2,000 horsepower combined rating, and a horizontal steam turbine of 2,000 horsepower capacity. There were the usual direct-connected alternators for 2,300-volt service, and seven auxiliary engines having a total rating of 214 horsepower. The latter were used in the operation of various pumps, cooling tower, fan equipment, exciters, etc., and the fuel in the station was handled by automatic stokers that were engine-driven. The force required to operate this station the year through included five engineers, two oilers, two steam fitters, three firemen, and two switchboard men.

The second and smaller station was equipped with five water-tube boilers having a total rating of 1,250 horsepower. There were three direct-connected alternators of the 2,300-volt, three-phase, revolving-field type, each being driven by a vertical cross-compound condensing engine. The total engine rating was 3,000 horsepower, the largest machine being rated at 1,500 horsepower, and the smallest at 600 horsepower. In the second station the water conditions did not require the use of a cooling tower, and the plant was hand-fired. There was one steam-driven exciter, the rest of this equipment being motor-operated. The station payroll covered the following men: four engineers, three oilers, three firemen and two helpers.

The larger of these plants burned bituminous coal and coke breeze, the former costing $4.08 per ton delivered at the station and the latter, $1.75 per ton. Over 6,000 tons of the former and over 1,000 tons of the latter were consumed. The total energy generated and delivered at the switchboard of the station was 4,715,000 kilowatt-hours, and the total sales were 3,548,000 kilowatt-hours. The power sales of the company were 881,000 kilowatt-hours, and the maximum load during the year was 1,650 kilowatts. The load factor of the station, or the average output for the year divided by the maximum, was thirty-two per cent. The average load on the bus bars was 530 kilowatts.

The smaller station burned bituminous coal and coke, at respective costs per ton of $4.89 and $4.07, delivered at the power house. About 3,700 tons of coal and 2,850 tons of coke were used during the year. The output at the busbars was 4,006,000 kilowatt-hours, and the total sales were 3,788,000 kilowatt-hours. This company sold more than half its output for electric motor service, a total of 2,316,000 kilowatt-hours being billed to power customers. The maximum load was 1,510 kilowatts, and the average load for the year 458 kilowatts, making the load factor

thirty per cent. The similarity of the load factors illustrates the danger of assuming that a plant without a large power load cannot produce under as favorable conditions as another with a heavy motor service. Given two plants in the same territory, the one with the larger day load of motor installations would tend to show the better economy, other things being equal, but in this particular case the company without the large and valuable power load enjoys the patronage of a highly diversified territory, including in its area several thickly populated suburban cities drawing upon the plant for a varied service at all hours of the day.

The detailed operating results at the two stations are unusually close, practically the entire difference in the final cost being due to the higher price of fuel per ton in the smaller station. The total cost of manufacture at the switchboard of the larger plant, excluding fixed charges, was $50,800, or 1.08 cents per kilowatt-hour. The smaller station turned out its current at a total cost of $49,600, or 1.24 cents per kilowatt-hour. In the former case the fuel cost per kilowatt-hour was 0.57 cent; and in the latter, 0.74 cent. The labor cost per kilowatt-hour was practically the same in each plant, being 0.31 cent in the larger installation and 0.30 cent in the smaller one. The smaller station had the advantage of a somewhat simpler arrangement of apparatus, especially in connection with the auxiliaries and switchboard installation. In the larger plant the fuel cost for the year was $26,780 against $29,670 in the smaller station; and the wages cost in the larger plant was $14,812 against $12,105 for the smaller outfit. The oil and waste, water, building and plant repairs, were 0.20 cent in each case, per kilowatt-hour generated.

These figures indicate that the standards of operation in one station tend to control the service of the other. It is probable that the use of the steam turbo-alternator in the larger station helps to maintain the station economy at good figures during times of light load, since the efficiency of such units tends to approximate more nearly to a straight line from half load to full rating than is the case with the steam engine. The similarity of the labor requirements, the maintenance of about the same class of equipment in each plant in point of modernity, and the active co-operation among the managers of the syndicate to advance the interests of the organization as a whole no less than those of the local properties are significant. The primary cost of coal is the one issue of importance in comparing these two installations, judging from the past year's results. A practical difference of one-sixth of a cent per kilowatt-hour in fuel cost means an added cost of nearly $7,000 per year on a 4,000,000 kilowatt-hour output. Without an investigation of the fuel conditions on the ground, it is difficult to point out how the coal cost can be reduced at the smaller plant, if at all. Possibly a study of the fuel combustion conditions would indicate an opportunity to use other mixtures of coal at a lower price.

## SOME FEATURES OF TELEPHONE SERVICE.

The address of Mr. Bernard E. Sunny, president of the Chicago Telephone Company, delivered before the Chicago Electric Club last week and reported on other pages of this issue, indirectly answers a question which perhaps many are not familiar with, namely, why telephone rates are higher in large cities than in smaller ones.

It was demonstrated that as an exchange grows the cost of furnishing under any particular class of service, the unlimited use of the entire system, or plant, to each patron increases, and that an increase in the charge is necessary.

In buying electric light, the consumer knows he is getting it for so much per kilowatt-hour. In buying gas, he knows he is getting it for so much per thousand cubic feet. In fact, when buying anything except telephone service the purchaser and seller both recognize a unit. The telephone company does not sell the telephone instrument, neither does it rent it to the subscriber. In any exchange where there is a flat rate for the unlimited use of the entire plant, the company places this plant, consisting of switchboards, central office apparatus, underground conduit, cables, poles, wires, etc., all at the subscriber's disposal, and places the instrument in his office or residence in order that the subscriber may be able to avail himself of the different uses of the plant.

In an exchange with a small number of subscribers the cost of the plant is not very great and its construction is simple. The switchboard is inexpensive and easily maintained, not requiring the services of experts. The poles are small and the cables, if any, are not only small but of short length. No underground construction is necessary. As the exchange increases in size, these conditions gradually change and in due course of time it is necessary to have underground conduits and cables, multiple switchboards, power plants, and highly paid expert attendants.

To illustrate: A switchboard for an exchange of 300 lines or less can be purchased at from $1.50 to $3.00 per line, while a switchboard with a maximum capacity of 10,000 lines, but equipped for only 6,000 lines, and with fifteen sections installed, would cost about $120,000, or $20 per line, and one fully equipped for 10,000 lines and twenty-five sections would cost about $250,000, or $25 per line. Thus it would seem that on this one item alone the cost in a large exchange is ten times greater than in a small one.

Illustrations could also be made comparing the cost of underground conduit and cable, underground distribution in the central part of the city, the cost of real estate, of taxes, of salaries, of damage and compensation, of bad debts and forced reconstruction due to abnormal growths. In fact, practically all items of furnishing service in a large city increase as compared with the cost of similar items in a small town, and when the unlimited use of the entire plant is furnished at a flat rate this rate must necessarily be larger per station as the city grows and it should not be overlooked that the value of the service and its efficiency increase just as rapidly.

### Chicago Electric Club.

The regular meeting of the Chicago Electric Club on Wednesday, December 15, was a decidedly successful one both in point of attendance and interest, the speaker on this occasion being Bernard E. Sunny, president of the Chicago Telephone Company, Chicago, Ill.

As an indication of the conditions to be found in the early days, Mr. Sunny read the list of rules and regulations printed in the telephone directory of 1878. These rules, which required the calling party to wait ten minutes before repeating a call if unsuccessful in obtaining the desired party, and which specified various rings of the signal bells for different purposes, etc., afforded much amusement.

In 1878 Chicago was served by two telephone companies, namely, the Bell Company and the Western Union Telegraph Company, which was also engaged in the telephone business at that time. Each of these companies had in operation one exchange. Reasonable progress was made during the succeeding years until 1882 when the two existing companies were consolidated and the present Chicago Telephone Company organized.

That the growth of the telephone business in Chicago since that time has been phenomenal was demonstrated by statistics presented by the speaker, showing that there are at present 205,000 telephones in use with over thirty exchanges.

To accommodate subscribers in various financial circumstances, and also for the purpose of classifying according to the needs of the subscribers, the telephone service is divided into the following classes: Ten-party lines, four-party lines, two-party lines, single-party lines and private branch exchanges. Each division, with the exception of the ten-party lines which are now almost obsolete, represents 85,000, 31,000, 43,000 and 4,375 subscribers, respectively. The latter figure represents the number of private exchanges, to which an average of forty separate lines are connected.

There are over 52,000 lines in the business district, and these are divided among the three downtown exchanges as follows: Main office, 13,500; Central office, 22,350; and the Harrison office, 17,705. These stations are in turn connected to each other by trunk lines the number of these being proportionate to the flow of traffic and to the direction of the flow.

During the average day approximately 1,300,000 calls are handled, which necessitates the services of 3,750 operators. The average speed in answering calls is four seconds, although this varies greatly according to the nature of the call, and the total time required to complete a telephone connection is about twenty-five seconds.

To show that the efficiency of the service has increased in proportion to its growth, Mr. Sunny gave some statistics which are indeed interesting. For the average day 78.5 per cent of the calls handled are completed satisfactorily; thirteen per cent receive the busy signal; three per cent receive the wrong number; and 1.5 per cent are unable to be connected due to errors on the part of the subscribers.

Another interesting phase of the subject which demonstrates the greater efficiency of the service now as compared with that of a few years ago is the number of complaints reported. During the present year, out of 1,250,000 cases received by the general manager, upon investigation resulted in there being only 452 cases of actual trouble. The speaker gave figures showing the increased amount of trouble reported from lightning during heavy storms in the summer, and also demonstrated the damaging effects of heavy storms in the winter. The former is being overcome to a large extent by the installation of efficient protective devices which, with few exceptions, have performed their functions entirely satisfactorily.

Other interesting data given was that the busiest part of the telephone day is between ten and eleven o'clock in the morning, the operators handling during this hour about ten per cent of the entire day's business. The number of requests for the time of day has reached 60,000 in a single day, the larger per cent of these calls coming in between seven and eight o'clock in the morning.

Regarding the question of a public service corporation's having a monopoly on the business, Mr. Sunny agreed with Samuel Insull's ideas expressed at a previous meeting of the club and reported in these columns to the effect that such corporations should have a monopoly. He also stated that the Chicago Telephone Company is a municipally controlled monopoly, its bookkeeping department being under the direction of the City Comptroller and its service being under the supervision of the Commissioner of Public Works. By reason of an ordinance passed not long ago the city has reserved the right to purchase the telephone company in ten years and again in fifteen years after the date of passing the ordinance. Also after thirty months from the date of the passage of this ordinance the city will appoint a committee to regulate the service of the telephone company for a period of five years, and it was the speaker's opinion that this committee, co-operating with the telephone company, would establish a system of rates which would be fair to the subscriber, fair to the telephone company, and would result in the general betterment of the entire service.

Following this interesting address and upon the invitation of President Frederic P. Vose, several men prominently associated with the telephone business in the earlier days, recited incidents in connection with this subject. Among those who were heard was Chas. W. Price, Kempster B. Miller, and J. W. Johnson.

Mr. Miller stated that an important and interesting feature of the growth of the telephone business was the fact that the telephone company every year installs 25,000 additional telephones—this amount being equal the total number of instruments in service ten years ago.

### New York Subway Plans.

A plan for a belt subway line to cost $130,000,000 has been submitted to William R. Willcox of the Public Service Commission by E. J. Farrell and John J. Hopkins. The line is to surround Manhattan and the Bronx, extending under the East River to Brooklyn, there to connect with the Fourth Avenue subway now being built and later, when practicable, by way to Fort Hamilton and the Narrows to Staten Island, and also by a Fifty-ninth Street crosstown under the East River into Queens, reaching several Long Island points.

Under the plan the proposed subway system is to be built in about twenty-four sections of about one mile each, and with four tracks, which will run around the two Boroughs of Manhattan and the Bronx.

### American Exposition in Berlin.

As previously mentioned in these columns America is to have a comprehensive and representative exposition in Berlin in 1910. Manufacturers and business men throughout the country are displaying a lively interest in the undertaking and applications for space have been received by the American committee from many states. The indications are that every branch of American progress will be shown at the exposition.

It is but natural that the United States should seek to hold an All-American Exposition in Europe; for our export trade in that direction has reached splendid proportions and it is constantly increasing. Our exports to Europe for the year 1908 reached the enormous sum of $1,270,016,773. It is also easily seen why the projectors of the exposition selected Germany as the country in which to hold it, for that country alone received $274,178,712 of our export trade, nearly one-fourth of the total amount going to Europe. It is often asserted of Berlin that that city is the commercial heart of the mainland of Europe.

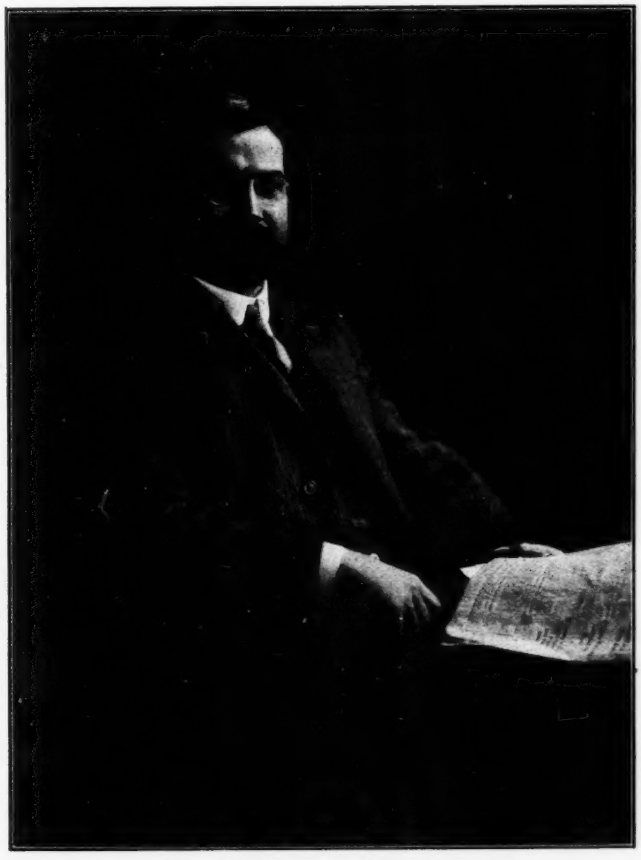
Electricity is fast taking the place of manual labor in the mining industries and the construction of electric railroads is becoming general. In the mines, hoisting, pumping, drilling, ventilation and the transportation of workmen will be done hereafter by electricity. Foreign manufacturers will hardly be able to meet the increasing demand for electrical machinery and other products necessary to the industry so that the United States had an exceptional opportunity for a lucrative business. The export of electrical machinery to Europe in 1908 was $1,855,644.

Impetus has been given the exposition enterprise by the recent appointment of former Governor David R. Francis, of Missouri, to the office of first vice-president of the American committee. Mr. Francis was president of the St. Louis World's Fair in 1904 and the success of that great exposition was largely due to his management.

There has just been issued by the American committee, whose office is at 50 Church Street, New York, an attractively arranged prospectus of the exposition, which, in addition to outlining the objects and advantages of the enterprise, contains many photographic views of the Exposition Palace and portraits of the distinguished sponsors of the undertaking.

### Henry L. Doherty.

Henry L. Doherty has long been a familiar figure at conventions and meetings of those who have to do with public service corporations. Resourceful, energetic and farseeing, he is one of the most enterprising of a host of strong men who have developed the electrical and allied fields of public service at a remarkable rate. Mr. Doherty is an engineer, inventor, manager, executive and banker. His early career was one of varied experience along engineering and managerial lines. He formed the firm of Henry L. Doherty & Co., in 1905. He invented several pieces of gas apparatus, cement-burning apparatus, fuel-using processes, and has probably given the subject of methods of charging for public utilities more study and developed it further than any other one man in the country. He is president of the American Gas and Electric Company, Denver (Colo.) Gas and Electric Company, Lincoln (Neb.) Gas and Electric Light Company, and is either president or director of a dozen others. In 1898 he was winner of the Beall gold medal of the American Gas Light Association. He is a member of many of the leading engineering and scientific societies, and of the Lawyers, Lotus, Democratic (N. Y. city), Denver (Denver), Minnesota (St. Paul), Commercial (Lincoln), Columbus (Ohio) clubs. He is a ready and forceful writer and speaker, and has contributed a number of classical papers to the proceedings of the National Electric Light Association and the American Institute of Electrical Engineers. On December 16 he delivered an important address on the development and operation of hydroelectric plants before the last-mentioned organization.



HENRY L. DOHERTY,
Who delivered an important paper on development and operation of hydroelectric plants, before the American Institute of Electric Engineers, New York, December 16.

### Kings County Electric.

The Kings County Electric Light and Power Co. has filed with the New York Public Service Commission an amended application for approval of an issue of convertible debenture bonds for $5,000,000. In the original application the company stated that $2,500,000 was to be used for immediate construction work and improvements, and $2,500,000 to reimburse the company's treasury.

In giving an explanation for the latter item it was stated that an equal amount had been expended from the surplus of the company, including the money that had been deposited by consumers on meter deposits, amounting to nearly $100,000. Commissioner Maltbie questioned the power of the commission in regard to approving a bond issue for such purposes, and suggested that the company make an amended application dividing the two items. This has been done and a hearing set for December 27. This company controls the Brooklyn Edison and the Amsterdam Electric Light and Power Company.

## FIFTH ANNUAL CONVENTION OF THE NATIONAL COMMERCIAL GAS ASSOCIATION.

NEW YORK CITY, DECEMBER 14-21.

Madison Square Garden, New York city, was the scene of one of the greatest displays of gas appliances ever made in this or any other country, on the occasion of the fifth annual convention of the National Commercial Gas Association, from December 14-21.

The National Commercial Gas Association held its fifth annual convention for four days beginning the 14th, and on Friday evening of the 17th there was a joint meeting with the Illuminating Engineering Society.

There were seventeen papers read and three set speeches at the general assembly on Tuesday evening. The president, J. D. Shattuck, was in the chair at all of the sessions, which were held in the Concert Hall and well attended.

The subjects of the papers were classified as follows: Lighting (5), New Business (3), Management (2), Gas Engines and Water Heaters (3), Advertising (1), Miscellaneous (3).

The papers which will probably be of interest to the electrical fraternity included one on street lighting, by E. N. Wrightington of Boston, Mass. This gives a rather belated answer to the criticisms which have been heaped upon gas for public lighting in that city during the past year.

From the discussion it was evident that a mistake had been made in attempting to light the much-traveled thoroughfares by means of low-pressure gas in competition with the modern electric arc lamp.

The paper which produced the greatest discussion, entitled "The Best Policy to Follow to Increase Gas Sales in a Town Where Both Gas and Electric Companies are Under One Management," was prepared by ten men and presented by the editor, Clare N. Stannard, of Denver, Colo.

The conclusion of the editors that the electric end should carry all of the lighting in the better class of residences and business buildings was the chief point of argument, and it seemed to be the consensus of opinion that unless consumers were given the opportunity to use either gas or electricity that they would not be satisfied. In summing up Mr. Stannard agreed that all houses should be piped for gas lighting as well as for the fuel appliances.

In the paper entitled "Advertising to Sell Gas," T. R. Elcock, Jr., pointed out the lines along which this feature of publicity could best be handled.

The arguments in favor of gas engines in competition with either central stations or isolated steam plants as presented by W. W. Cummings, of Boston, Mass., told their end of the story very well.

The importance of good will as an asset was well brought out in the paper on "Increasing Gas Sales to Existing Consumers" by Glenn C. Chamberlain. He described the results of a year's work at Grand Rapids, Mich.

### JOINT MEETING.

The technical sessions concluded with a joint meeting with the New York Section of the Illuminating Engineering Society. H. Thurston Owens delivered an illustrated lecture on "Street Lighting Fixtures." The views covered the practice abroad[1] as well as at home. He showed the large use of flaming arc lamps and the fixtures upon which they are hung in the large cities abroad, and closed with a short review of what is going on at home. He stated that during the period from 1905 to 1907 there had been an increase of nearly 40,000 public lamps in the 158 cities of over 30,000 population in the country, or over nine per cent. The greatest increase was in electric lighting, with over 17 per cent.

At the end of the period there were some 40,000 open flame gas lamps and nearly 45,000 open arc lamps, so that there is still room for considerable improvement.

The lecture was followed by a description of the lighting in the new sales rooms of the Consolidated Gas Company of New York City by V. R. Lansigh and C. B. Rowe, which was read by the latter.

One of the features of the installation was a set of small booths papered in different colors and all lighted with the same size lamp so as to bring out the marked difference in illumination due to absorbtion.

### THE GAS SHOW.

The garden, canopied in pink and white and lavishly lighted, was indeed a credit to the association.

Only general illumination was provided, the units consisting of six clusters of Humphrey five-burner inverted arcs having thirteen lamps to each cluster, and twenty-eight of the same type, five to each cluster, a total of 218 arc lamps. Around the balcony between each girder there were arches of single Reflex burners, some 500 being used.

The arrangement of the booths was somewhat different than is usually the case, as there were five aisles instead of three, which gave more room for the crowds. There were nearly 200 booths and over half as many exhibitors. Expressed on a percentage basis the goods exhibited are as follows; Stoves, 33; fuel, 18; water heaters, 8; lighting, 21; miscellaneous, 20. The exterior of the building was lighted by both Humphrey and Welsbach inverted arcs.

### NEW OFFICERS.

The following officers were elected for the ensuing year:

President, E. N. Wrightington, Boston.

First vice-president, H. B. McLean, New York.

Second vice-president, C. H. Graf, Indianapolis.

Third vice-president, A. V. Wainwright, New York.

Treasurer, P. S. Young, Newark.

Secretary, L. S. Bigelow, New York.

An important feature of the gathering which was neither technical nor social was a meeting on Tuesday evening, when George B. Cortelyou, president of the Consolidated Gas Company, and T. N. McCarter, president of the Public Service Corporation of New Jersey, made excellent speeches.

Mr. Cortelyou spoke of the friendly relations which now exist between the public service corporation and the public, and showed that this was of vital importance to them both.

Mr. McCarter called attention to the dangers of municipal ownership and of management by commissions.

### Five-Cent Rate in Pasadena.

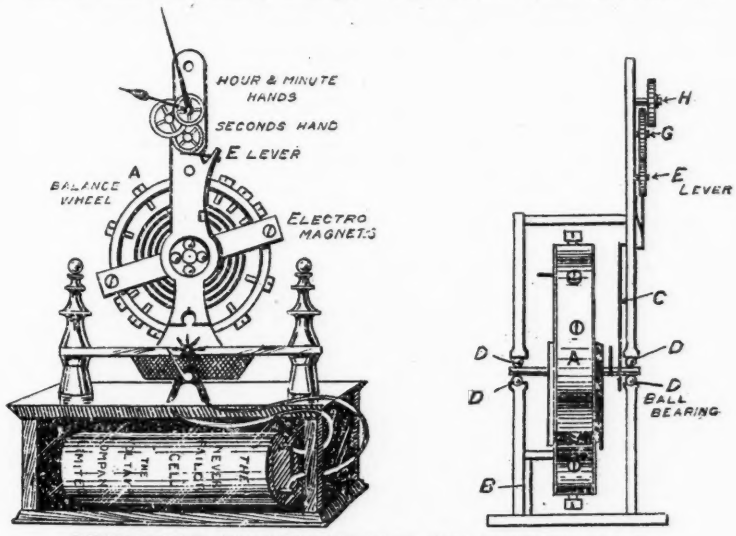
The Southern California Edison Company, consequent on the passage of an ordinance in Pasadena, Cal., compelling the charging for electric-lighting service by meter measurement only, has issued a new scale of rates. For 100 kilowatt-hours per month the maximum charge is five cents per kilowatt-hour, or four cents when 2,000 kilowatt-hours are used each month.

1 See Electrical Review and Western Electrician, November 13.

### An Electric Clock.

The electric clock invented by a Mr. Kutnow, which was mentioned in a previous issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN as having been exhibited before King Edward of England, is described and illustrated below, the description and diagrams being taken from the *English Mechanic and World of Science*, a well-known English semipopular mechanical and scientific journal.

The construction of the clock is extremely simple, as may be seen from the accompanying diagrams, and it is claimed that the clock will run for 1,000 hours and that it will go in any position. A single dry cell is fixed under the clock, from which one wire is connected to the plate of iron which runs horizontally at the base of the clock. Above this plate hangs a large wheel, constructed like the balance-wheel of a watch, which just clears the plate as it rotates. At the back is a spring similar to the hairspring of a watch. This wheel has a small magnet running through its center, which is magnetized by the electric current, and pulls its end on the surface of the wheel round towards the horizontal plate below. The point, then, is to utilize this pulling power of the magnet just at the moment that it will give the necessary impetus to the wheel. This is effected by a thin strip of steel, *B*, which is connected with one terminal of the battery; the other, as previously explained, being connected with the horizontal plate below the wheel. As the wheel swings round, this strip of steel comes in contact with a knob, through which the current passes, whereupon, the magnet becoming charged, the point is pulled down sharply to the horizontal plate. Passing over this, the magnet is demagnetized, and the wheel swings on till the force of the oscillating spring brings it back again. The oscillation is timed, and can be regulated by the spring behind to take exactly a second each way. The movement is conveyed directly by a lever to the second hand, and the minute and hour hands are connected in the usual manner.




PERSPECTIVE AND SIDE VIEWS OF THE ELECTRIC CLOCK.

### Pittsburg Section, American Institute of Electrical Engineers.

The Pittsburg Section of the American Institute of Electrical Engineers held its regular monthly meeting for December in the lecture hall of Carnegie Institute, on December 14. A paper was presented by E. B. Tuttle and W. V. Read, of the Central District and Printing Telegraph Company, on "Telephone Transmission and the Oscillograph." Mr. Tuttle exhibited oscillograms showing the character of current waves produced by different types of transmitters, the effect of a cable in the subscriber's loop and in the inter-office trunk line.

The phase shift produced by a loaded cable was shown both for the current and voltage waves at the two ends of the circuit. Mr. Tuttle has succeeded in obtaining oscillograph curves of telephone speech currents which are capable of accurate analysis to the ninth harmonic. One thing made very evident in the paper was the fact that the even harmonics are fully as important as are the odd harmonics.

S. P. Grace and R. A. L. Snyder, of the Central District and Printing Telegraph Company; H. W. Fisher, of the Standard Underground Cable Company, and B. P. Rowe, of the Westinghouse Electric and Manufacturing Company, discussed the paper and stated that they considered the results given to be of very great importance to the telephone industry.

### Brooklyn Rapid Transit Pension Plan.

Announcement has been made that the Brooklyn Rapid Transit Company has decided to inaugurate a pension system for its veteran employes. The details of the plan have been approved by the board of directors, and within a short time the scheme will be in working order.

A regular schedule has been decided upon. Any employe who has reached the age of seventy years, whether incapacitated or not, and any employe who has reached the age of from sixty-five to sixty-nine years and who has become incapacitated, and has made application or has been recommended for retirement, will be entitled to receive fifty per cent of his average monthly pay in the ten years immediately preceding retirement, if he has been in continuous service thirty-five years or more. If his service is between thirty and thirty-five years, continuously, this pension will be adjusted at forty per cent. If the continuous service is between twenty-five and thirty years, the pension will be adjusted at thirty per cent. Further provision is made for employes under sixty-five years of age and of thirty years' continuous service, who have become incapacitated. These last may also be admitted to the pension provisions.

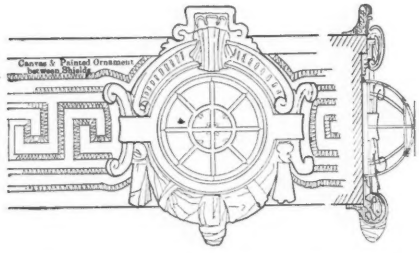
### New York Elevated Business Improving.

The Interborough Rapid Transit Company has given figures which show that while traffic on the subway has steadily increased since it was opened, the patronage of the company's elevated lines has not fallen off, but will surpass all previous records this year. The banner year with the elevated was 1904, the year before the subway was opened, when it carried 286,534,195 passengers. If the increase for the present year keeps up in proportion the figures for 1904 will be beaten this year by more than 5,000,000.

## THE CHICAGO ELECTRICAL SHOW.

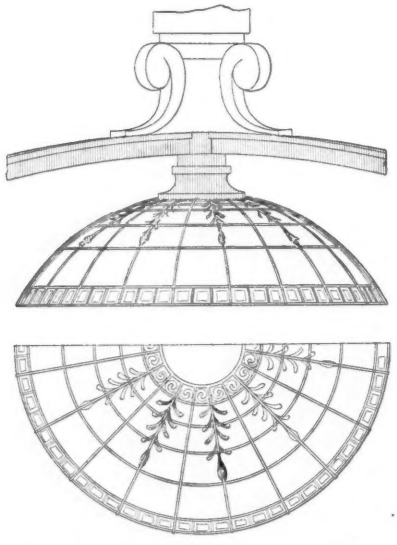
ILLUMINATION AND DECORATIVE FEATURES.

The plans for the 1910 electrical show, which will be held at the Coliseum, Chicago, Ill., January 15 to 29, under the auspices of the Electrical Trades Exposition Company are pro-




DETAILS OF BALCONY FRIEZE AND SHIELD TRANSPARENCY.

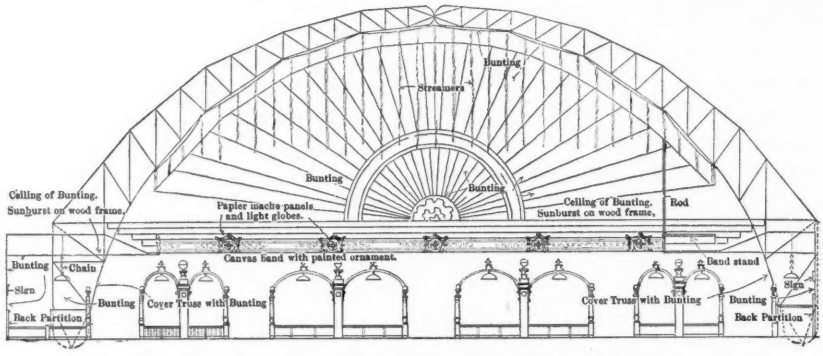
ceeding apace. With the returns just in it is evident that in point of space contracted for the show will be a record-breaker and that a truly representative exposition of electrical and kindred devices will be maintained. A number of features of extraordinary interest will be shown; notably the Wright aeroplane, the property of the United States Government, in charge of the Government wireless and aeroplane experts, the model garage, and the lecture room where the Common-



DETAILS OF FIXTURE OVER CENTER OF BOOTH.

wealth Edison Company will make demonstrations of all manner of electrical devices.

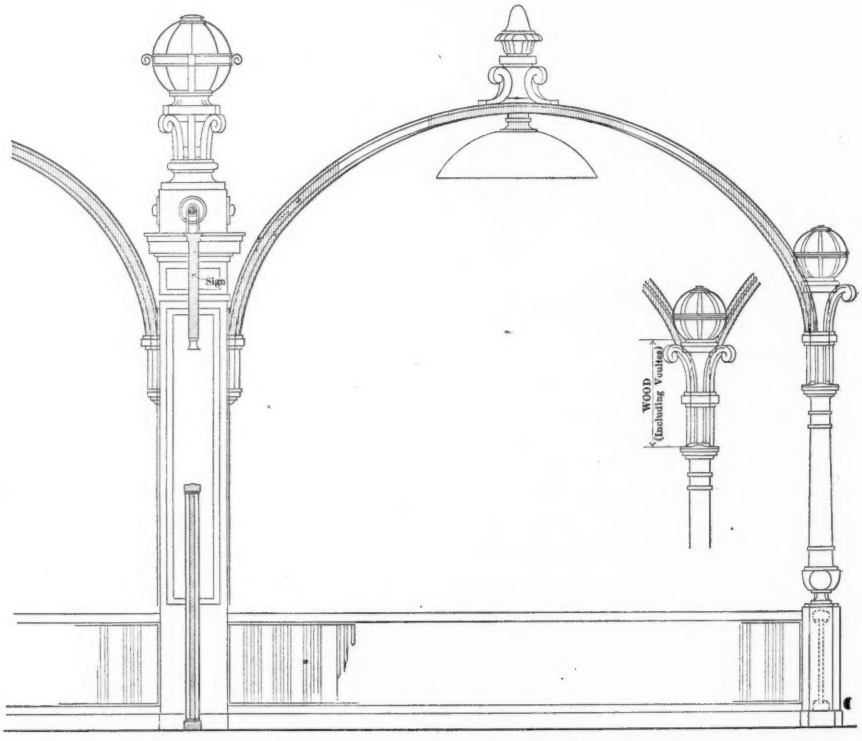
In point of illumination and decoration the Chicago show has always set a mark which has established new degrees of effectiveness. The plans for the coming show, it is expected, will develop a lighting and decorative scheme which will far excel the remarkable spectacles which have heretofore been worked out. The scheme this year will be essentially decorative and spectacular, and still the illumination of the objects exhibited, and, in fact, the flux of light over the entire illuminating plane will have a higher value than heretofore. The light intensity will be softened by the use of multicolor effects, and the enlarging of a familiar stage picture will give the overhead decorations a strikingly picturesque appearance.




DETAILS OF LIGHTING ARRANGEMENT AND CEILING DECORATION.

Over each booth there will be a continuous arched truss, the apex of the crossing arched members being directly above the center of each booth. Over the larger spaces there will be a cluster of five 100-watt tungsten lamps with Holophane diffusing reflectors partially surrounded by an art glass dome. Over the smaller spaces there will be a similar light cluster equipped with five sixty-watt lamps. On the corner posts of the spaces there will be a sixty-watt lamp inside of the art glass effect, and on the taller posts intercepting the loops there will be a 150-watt lamp enclosed in the art glass effect.

The side spaces will be illuminated by similar tungsten lamp sets and art




TYPICAL CROSS SECTION, SHOWING LIGHTING ARRANGEMENTS FOR BOOTHS.

glass domes. These fixtures, however, will be suspended by chains from cranes extending from the balcony.

Extending all around the balcony rail which flanks the exhibition space on every side, there will be a canvas frieze which will be painted in symbolic representations, with a shield and transparency in art glass effect spaced at every twenty-two feet. Behind each shield there will be placed six sixteen-candlepower carbon lamps. The windows throughout the building will be shielded by heavy paper covering to exclude all outside light.

The entire canopy of the dome will be covered with dark colored bunting, shutting off the roof trusses and steel work, and a continuous effect of a gold and silver sea will be created by gold and silver tinsel streamers. At each end of the Coliseum the rays from a battery of Ryan scintillators will throw out a flood-light effect, giving the dome an appearance of an iridescent and scintillating mass of color. The scintillators will be so arranged and focused that every portion of the floating tinsel will be flooded with light.

It is expected that the model garage, which will be installed by the Commonwealth Edison Company, will prove of great value in demonstrating to the central-station visitors the practicability of building up a valuable service in the charging of vehicle batteries. The lecture hall will also present a valuable opportunity for the householder to become acquainted with the methods of operating domestic appliances and with the economies which can be secured through the utilization of electric utensils.

### Peat Fuel for Large Electric Plant.

Peat fuel will be used in an electric station being erected in Germany. The new plant is being installed in the region to the southwest of Oldenburg, and it lies in the vicinity of extensive peat fields from which the supply is to be secured. The electric plant is laid out on a large scale, and when completed it will be one of the largest in the country. It is to furnish current over a network of power lines which will cover the entire Duchy of Oldenburg, within a radius of 40 miles.

Probably the new station will be completed about the end of next year, and in the meantime measures are being taken to find out about what amount of current will be taken.

### National Electric Light Association's Commercial Programme Committee Meets.

The first meeting of the commercial programme committee of the National Electric Light Association was held at the offices of Henry L. Doherty & Company in New York city recently to formulate plans for the next convention. There is a strong sentiment in favor of a curtailment in the length of the commercial programme next year, so that the principal topics of interest may be taken up and discussed widely. With this in view, therefore, fewer papers will be presented, and no effort will be spared to bring out a thorough discussion from all members.

The committee will hold its second meeting in Chicago during the fifth annual Electrical Show, as the guests of H. M. Byllesby & Company.

### Westchester and Portchester Roads to Unite.

The New York city Board of Estimate has approved the application of the New York & Westchester Railway to consolidate with the New York, Portchester & Boston Railway under the former name.

The application has been before the board for a year. During that time construction work in the Bronx has been held up, although pushed vigorously in Westchester. Both companies are now owned by the New York, New Haven & Hartford.

Francis Lynde Stetson appeared for the petitioners, and assured the board that haste would be made in giving swift transportation between One Hundred and Thirty-second Street, the Bronx, and all parts of Westchester. The route, as agreed upon, is from Portchester along the Sound shore to Mount Vernon, where another branch from White Plains will join the Sound line, and the two combined will parallel the New Rochelle branch of the New Haven to Lincoln Avenue and One Hundred and Thirty-second Street.

Authority is given to abandon such portions of the routes of the two companies as are not necessary to form a continuous route from the Harlem River in New York city to Portchester, Westchester County, with a branch line from One Hundred and Seventy-seventh Street to Throgg's Neck, and another from Mount Vernon to White Plains, or to Elmsford, in case the application to abandon that portion of the line from White Plains to Elmsford should hereafter be denied. The construction of the consolidated railroad as a single road is approved.

The Commission has denied the company's application so far as it requests the abandonment of a portion of its route from Classon's Point to Throgg's Neck.

### Opening in Germany for Electrical Hearing Devices.

An American consular officer in Germany reports that electrical hearing devices consisting of an earpiece and sound receiver have not been produced by German manufacturers and are apparently unknown in that market. He states that dealers in this class of devices express a lively interest in the subject and furnishes the names of two firms that would like to secure samples for distribution, to be tested as to practicability. Before attempting to introduce this article the firms are anxious to know whether or not it is protected by a German patent. If this is not the case, it would be useless to build up a trade, which could be easily diverted by German manufacturers who might produce the same article at a lower price. Inquiries should be addressed to the Bureau of Manufacturers, Washington, D. C., quoting File No. 4207.

### Governmental Supervision of Electrical Supplies at Guatemala.

As the outcome of the special legislation giving the Guatemalan Government direct supervision of all electrical enterprises, a Presidential decree of October 21, 1909, allows the importation of electrical supplies only on written permission granted by the War Department upon application.

The decree also requires such enterprises now existing to furnish to competent authority the description and destination of all orders for material placed before the promulgation of the present law.

### Electrical Enterprise in Australia.

It is reported that no less than twenty suburban municipalities in the neighborhood of Melbourne, Australia, are promoting a scheme for the erection of electric-lighting and power stations. The services of an expert are to be employed to make a report on the cost of the venture.

## AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

PRESENTATION AND DISCUSSION OF MR. DOHERTY'S PAPER — "COMMENTS ON THE DEVELOPMENT AND OPERATION OF HYDROELECTRIC PLANTS."

The 241st meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York city, on Thursday evening, December 16, 1909. Directly after President L. B. Stillwell had called the meeting to order Secretary R. W. Pope announced that at the meeting of the Board of Directors held in the afternoon seventy-four Associates were transferred to the grade of Member. The meeting was held under the auspices of the high-tension committee of the Institute and was devoted to the presentation and discussion of a paper entitled "Comments on the Development and Operation of Hydroelectric Plants," by Henry L. Doherty.

In introducing the author of the paper, President Stillwell referred to a conference held two weeks previously with one of the prominent officials of the Federal Government, who is giving attention to the subject, the latter having remarked that he had examined the waterpower prospectuses of certain well-known banking firms, in which it was stated with positive conviction that profits of thirty and forty per cent were certain. On the other hand, if we look around us we find a large number of the more important waterpower developments which have been attempted in the last five years in the hands of receivers. The president of one of the electric companies said that he thought three per cent would be probably about the average return which the hydroelectric developments thus far have received upon their investment. True conservation demands the most prompt possible utilization of our water powers consistent with due regard to the rights of the people as a whole.

Mr. Doherty then presented his excellent paper, an abstract of which follows:

Near the beginning of his paper Mr. Doherty stated that there is probably no other class of securities which deserves so well the support of the public as those issued by companies owning and operating successful waterpower properties, and having a permanent and relatively non-competitive market. All of our waterpower plants will tend to grow more and more valuable, as it is improbable that fuel will ever sell at a lesser cost, and more than probable that the cost will gradually increase. Almost every other class of industrial or investment property is apt to depreciate at a much greater rate, and be subjected to greater seen and unforeseen risks. Compared with almost every other class of investment, a waterpower plant is far preferable. The source of supply is, in the main, perpetual, although in some instances somewhat modified by timber operations and changes in meteorological conditions.

Probably the greatest stroke of statesmanship of the last national administration was the interest aroused in the conservation of our natural resources. Unfortunately, the efforts of the administration were either largely misdirected or very generally misunderstood in regard to water powers. Immense amounts of power are daily going to waste. The tendency of the Federal Government, and of many of the state governments, seems to be directed toward obstructing rather than encouraging the development of water powers. The most pressing need in the matter of the conservation of our natural resources lies in the direction of conserving our various sources of fuel supply. Every undeveloped water power means a constant unnecessary fuel consumption. Governments, both state and national, should remove as far as possible every unnecessary obstacle to waterpower development. Rights of eminent domain should be given universally to waterpower projects. Encouragement, and perhaps direction, should be given which will insure the development of the greatest possible portion of the total energy available from our streams.

Combination projects for both irrigation and power can often be made highly profitable where commercial success for either project alone would be impossible. It is therefore necessary that the engineer who has the responsibility of determining the value of prospective power developments should be proficient in the engineering of irrigation—and it is probably impossible fully to cover the field of hydroelectric engineering as well. This opens up to this Institute a necessary field of work which even now seems somewhat strange and a few years ago would have been entirely remote. Power and irrigation projects, wherein the power must be generated at one point and transmitted to another point and there provide irrigation by means of pumping, is alone worth serious consideration. The present state of the art in electrochemical processes is a factor which makes possible the profitable development of many water powers. Still further developments along electrochemical lines may add materially to the value of waterpower projects which now have no available market. Special attention should be paid to processes which do not require a continuous supply of current, thus permitting the utilization of power from water which would otherwise run to waste.

Failure to realize expectations in regard to cost of development, amount of power to be sold, existence of market (or of market at the price anticipated) and reliable service, have played an important part in the retardation of development of waterpower projects. It would contribute much to the ease of developing the now unused water powers if these difficulties could be overcome, or if the public could be made to understand the degree of risk and the cause for the existence of the risk. The engineering investigation to determine the cost of a hydroelectric power proposition, and the exact amount of power available, is often a very expensive matter. There is no reason why waterpower projects, with reliable stream gaugings covering a number of years, cannot be estimated, as to cost of construction and earnings, to a degree of accuracy closely approaching that which now pertains to the construction and earnings of modern office buildings, or similar enterprises. After a proper examination has been made of a proposed waterpower plant, where the behavior of the stream is a matter of reliable record for several years, an enterprise of this character can safely be undertaken on a very narrow margin of profit. If, however, the investing public is offered a proposition for which a return of ten per cent is estimated by conservative operators, based on careful and complete investigation, while other operators offer investment in a project for which they promise forty per cent, the ten per cent proposition is apt to go begging, even though it be well known that the source of the forty per cent proposition is not of a character to warrant the investment of real money.

The problem of reliable service from long transmission lines is much further from solution that all of the other problems that have done so much to contribute obstacles to rapid development. Good engineering talent and other proper precautions will insure that the cost of construction shall be no greater than that promised. The best of engineering talent does not seem, however, able to promise for a transmission line the same continuity of operation that can be secured from a steam plant located at the point where the power is to be used, and this introduces many serious obstacles to the development of our waterpower projects. The importance of continuity of service varies in degree with almost every customer served. To some industries a mishap which causes even a fall in voltage or a change in frequency may be a serious matter.

There have arisen many matters that deserve further thought and consideration by the engineers who are brought in contact with waterpower work, not only for their own benefit, but also for the education of the investing public and the power-purchasing public. Some of these are:

1. Methods to insure against interruptions or to lessen the harmful effect of interruptions.
2. Equipment to insure against interruptions or to lessen the harmful effect of interruptions.
3. Penalties for interruptions of service or insurance against interruptions.
4. Methods of charging.
5. Classes of service which can be advantageously supplied.
6. How to develop the market selected.
7. How to figure the amount of power it would pay to develop.
8. Calculations on depreciation.
9. Methods to determine the accuracy of engineer's estimates.

As to the first, with reliable reverse circuit-breakers, the tying in of several hydroelectric plants offers some insurance against interruptions. If central-station companies are to be supplied, it might sometimes be commercially practicable, where the reachable market greatly exceeds the capacity of the plant, to run the transmission lines to several central stations, with the idea that no one of the stations will attempt to take more than a portion of its base load, and will always have some steam apparatus in operation, the capacity of which can be quickly increased to take care of any interruption of service from the hydroelectric plant. In one case, arrangements were made several years ago to install a large steam turbine in connection with a relatively small waterpower plant, the generator of the steam turbine being designed to run as a motor while the vacuum on the turbine blades was maintained to reduce the windage loss, with the governor of the turbine so arranged that the slightest reduction in speed would cause the steam valves to open and the turbine immediately to pick up the load.

In regard to the second point, equipment, it is customary on all important transmission lines to use either two circuits on the same pole-line or two circuits each on its own pole-line, the latter being preferable. Perhaps greatly added reliability could be secured by the use of extra conductors on each pole-line, with effective switching apparatus that would enable the extra conductor to be brought into use as quickly as possible. The use of storage batteries is the first thing that occurs to one as a protection against interruptions, but their high investment cost and high cost of maintenance make them practically prohibitive when used purely to prevent interruptions of service. Gas engines would be almost ideal, but the high investment charges make them practically impossible. However, they have been adopted in some instances. A gas engine can be put into operation with marvelous rapidity, the time required being fixed by the time the electrical generator can be energized. Gas storage can be provided at a cost of approximately fifty dollars per 1,000 cubic feet, with no operating stand-by loss. Where producers are used, if the fires in the producers are maintained in proper condition, no storage capacity is needed; and perhaps no other similar class of apparatus can be run with such a small stand-by operating charge as a gas producer. Unfortunately, however, a gas-engine power station represents such a high first cost that, in spite of the higher efficiency of the gas engine and the lower stand-by losses of the gas-generating apparatus, the commercial cost for purely relay service is higher than for steam equipment.

If provision must be made for protection to service, a modern steam equipment offers about the lowest commercial cost. The boilers chosen should be able to have their fires withdrawn without causing leaks, and boilers should be chosen having the least stand-by loss in relation to their maximum capacity. This means a boiler of either very high capacity or very low radiation and ventilation losses. It is Mr. Doherty's opinion that for this class of service the internally fired boiler deserves careful consideration, but perhaps only in a modified form. This type of boiler, however, would be apt to be limited before other limiting features were reached by the lack of flue-gas conductivity of its fire tubes, which could be compensated for by a high draft pressure, but better compensated for by a modification in design. If boilers are not to be run on bank, but are to be fired up if an interruption occurs, the methods to be used for quickly starting the boilers are of great importance. The use of oil for fuel probably insures the greatest speed in starting up, but this fuel is often prohibitively expensive. It is, however, possible to use oil simply as an auxiliary in the starting of the boilers and then substitute coal, either hand-fired or machine-fired. Powdered coal is almost the equivalent of oil or gas, and is ideal for the class of service under consideration. It probably costs more to powder fuel than to burn it, as received, with machine stoking; but for relay service, while the operating cost per ton of coal handled would be more, the investment charge would probably be far less; and a great gain would be made in the speed of starting as compared with ordinary coal fires, and a much greater economy of labor could be secured.

In the choice of steam engines the steam turbine would seem to be the only one worth consideration. The low first cost of steam turbines, including building, foundations, etc., should alone be enough to warrant their adoption.

As regards the third point, Mr. Doherty gives some facts from a recent negotiation for the purchase and supply of power between a central-station company and a hydroelectric supply company, the question of continuity of service being given serious and detailed consideration. The central-station company was not desirous of collecting any penalties, but insisted that it should have service of such degree of reliability that no serious damage should result from such interruptions as might occur to the business it then held, and that would enable the same rapid development of the business as then obtained to be continued. It was concluded that any interruption, regardless of the length of such interruption, was harmful, and that the longer this interruption continued the more serious it became. It was also decided that one or more interruptions to the service immediately following the first interruption would prove more disastrous than if these interruptions were evenly distributed throughout the year. As insurance against excessive interruption was being sought, and as the only insurance possible was that to be obtained through operation of the steam plant, it was decided that insurance should be obtained by running the steam plant (fully energized and ready to instantly take the load in case of interruption to the hydroelectric service) at such times and for such lengths of time at a stretch as might be necessary to insure against interruptions coming oftener than at certain intervals. For example, to take an extreme case of the simplest form, suppose it had been decided that no interruptions of any kind whatsoever were permissible more than twice in any twelve months. Then after any interruption the steam plant would be run for six months, ready to take the load at any time in case of failure of the hydroelectric supply. This would insure only two interruptions per year; for if another interruption occurred after the end of the six months, the steam plant would be run another six months, thus completing the year with only two interruptions.

Regarding the fourth point, so many different methods of charging have been used that it is not surprising that even those skilled in the art are not familiar with all the deviations or the reasons for them. The individual user cannot afford to pay more than the value of the service to him. The cost to him of supplying his own requirements will depend on (*a*), the maximum capacity he may demand, regardless of when this demand may occur, and (*b*), the total amount of current generated. His investment will be influenced by certain preparatory charges; and, generally speaking, the larger the capacity installed the less the cost on a unit basis of capacity. While not always recognized, the cost of operation will be influenced, not only by the load-factor, but by the form of the load curve. The cost to the supplying company depends primarily on the demand of the consumer at the time of the hydroelectric company's simultaneous peak. Noncoincidence of maximum demands is, however, a legitimate source of profit to any supplying company.

In central-station practice large numbers of consumers are eventually developed having so small a current consumption and maximum demand that what might be termed the "consumer charge" assumes so much greater importance that it cannot be neglected. In fact, the condition has been reached where a large group of our central-station consumers requires a greater investment and maintenance expenditure for meters alone than is required for the generating equipment necessary to supply them. The capacity cost to supply many consumers is far greater to the hydroelectric company than would this same cost be if the consumer supplied himself. On the other hand, the cost for current to the hydroelectirc company is generally very small compared with the cost to the consumer were he to supply himself. The capacity the consumer should pay for should generally be based upon his absolute maximum peak experienced at any period throughout the year. Any other method of arriving at the capacity charge is apt to lead to great inequities.

In referring to the fifth point, Mr. Doherty gave the following illustration: The cost of service from an individual steam plant might be represented by 100,000 units per kilowatt of capacity plus 100 units for each kilowatt-hour, while the cost of service from a hydroelectric company might be as much as 400,000 units per kilowatt of capacity plus ten units per kilowatt-hour, being a relation in the first case as 1 is to 1,000 and in the second case as 1 is to 40,000. In spite of this great discrepancy in the relation between the fixed and output factors in the two cases, there is, nevertheless, the same cost of service at approximately thirty-eight per cent load-factor. With a load-factor of less than this the cost of service from the steam plant is the lesser, and at more than thirty-eight per cent load-factor the cost of service from the hydroelectric plant is the lesser.

By securing a number of consumers of a diversified character, even though more transmission lines are necessary, a good load-factor can often be secured in spite of the fact that the individual consumers may have poor load-factors. And by getting consumers to adapt their operations to the ability of the hydroelectric company to supply—that is to say, by using some form of what is now called "limited service"—this same end can be realized. Rational methods of charging, properly explained so they can be understood both by consumers and by prospective consumers, will do much to contribute to a good load-factor.

The future situation in the hydroelectric supply business will, however, eventually be that of the market greatly exceeding the supply, and the natural remedy will be the installation of steam plants by the hydroelectric companies to enable all possible available water to be used. Central-station steam-power plants have been made a success in competition with individual steam plants, and the success of steam plants in connection with hydroelectric plants should be even more pronounced.

Regarding the sixth point, Mr. Doherty said that many disappointments have been due to failure to develop the available market, or by tardy development of this market. A completed plant with an undeveloped load can create a deficit of expected earnings which will require many months of subsequent operation to wipe out. The transmission lines should be completed at the earliest possible moment, regardless of when the hydraulic generating plant can be put in commission; and if steam plants can not be taken over from prospective consumers to give in the aggregate enough capacity to carry on the development of the load, a relatively small steam plant in connection with the initial development of the waterpower plant should be installed new, and be added to as rapidly as required to insure a proper load when the hydroelectric generating station is placed in commission.

Delays in securing business are often due to the inability of industrial establishments to change over their equipment until a natural period of shutdown occurs; and failure to take advantage of one of these natural periods may defer the time of getting this business for a matter of many months, or perhaps years. The financial inability or indisposition of industrial plants to equip themselves with drives often occasions a serious retardation in the development of the expected load, and many power companies would find it greatly to their advantage to finance the expense for their customers to use electric power even though compelled to take long deferred payments and more or less risk.

As to his seventh point, it was the author's belief that eventually hydroelectric companies will develop and sell all of the power that can be generated economically. To do this, in the absence of extensive reservoir capacity, will necessitate a heat-engine auxiliary plant to supplement the hydraulic plant during low-water periods. Let us assume a hydroelectric development having simply a dam from which the water immediately enters the turbines and is immediately discharged to the river below the dam without any expensive canals, flumes, etc. In this character of development, hydraulic apparatus can be installed for carrying the peak load at a very much lower cost per kilowatt of capacity than by the use of steam. Not only this, but in this character of development all inequalities of load should be taken care of in the hydraulic plant; and if it is necessary to run the steam plant, the steam load should be run for such time, and at a uniform rate, as will secure the most economic generation of steam power. Steam plants or steam units can be started up and shut down only at considerable expense, while water units can be estarted up and shut down at practically no expense. In the character of development used above as an example, with a market which far exceeds the water supply, and where fuel is relatively high, the hydraulic capacity installed can be equal to the maixmum four days' supply of the stream.

Relative to the eighth point it was noted that practically all of the present assumptions for depreciation are too high. Figures applied to depreciation are used in a general sense without regard to what the plant consists of. The character of construction will largely influence the rate of depreciation. It is manifest that a plant having ten per cent of its investment in wooden poles and twenty per cent of its investment in a masonry dam will have a higher rate of depreciation than the plant which has only two per cent of its entire investment in wooden poles and over fifty per cent of its entire investment in a masonry dam.

Regarding his ninth and final point Mr. Doherty said that checking and rechecking plans by the same, or other, engineers may not disclose the omissions or errors, while complete independent reports by two or more separate engineering corps, and the comparison of these reports, will practically insure against all omission and all miscalculations, making it possible to do the development work for the cost anticipated with a realization of all the power and the expected market at the price predicted.

In conclusion the author stated that the Institute can do valuable work: By educating the public to the recognition of the value of hydroelectric securities; by such consideration and discussion as will bring about a proper attitude on the part of the public officials toward the development of our water powers; by papers and discussion on the methods of planning and developing which will insure that existing streams will be developed so as to realize more nearly their maximum economic possibilities; by papers and discussion on projects collateral to hydroelectric development; by encouraging frank and open discussion of past errors and their causes; by the consideration of methods and equipment to insure continuity of service and of penalties for and insurance against interruptions; and by educational work on methods of charging, rates of charging, and factors which go to make up the cost and value of service, coupled with the endeavor to standardize all terms of expression.

The spirited discussion, which followed the presentation of the paper, was under the leadership of Ralph D. Mershon, chairman of the high-tension committee. An unusually large number of members had contributed written discussion, so that the speakers were limited to seven minutes each.

Past-President Henry G. Stott opened the oral discussion by considering the question of the use of a steam plant as a reserve, and what proportion that steam plant should be, to get the most economical results. If we could take an ideal condition, such as the lighting of a large city, we would probably not end by wanting all our power from a hydraulic plant. We would find it possible to generate part of that power—and for many reasons—from a steam-power plant. There is only one type of steam plant to consider, and that is the steam-turbine plant. Mr. Stott thinks that type could be modified so as to cut the investment charges in two. There is only one problem we have in hand, and that is the fixed charges. The operating charges are almost negligible, compared to the fixed charges. The suggestion was made by the author of the paper that powdered fuel should be used, but there is no furnace found which will stand powdered fuel. The heat generated is so intense that no grate can stand it. Another point on which he differed from Mr. Doherty was as to holding the steam plant in reserve, he believing it better to operate it every day during peak loads. He considered the problem as based on a series of load curves representative of a large city, and which combined a lighting load, a railroad load and an industrial power load. Summing up his conclusions Mr. Stott showed a curve illustrating the average cost of power with different combinations of hydraulic and steam plant. The best combination in winter he stated as sixty per cent hydraulic and forty per cent steam. In the summer he said that forty per cent hydraulic and sixty per cent steam gives the best results.

S. E. Doane had prepared an extended discussion of most of the features covered in Mr. Doherty's paper. He thought that the mild language used in stating the importance of speedy development in water powers as a means of conserving our natural resources is entirely inadequate. Attention should be called to the value of nitrogen in maintaining the fertility of the soil. Coal burned under our boilers yields no nitrogen for fertilization, while the coal distilled for gas making and the coal carbonized for coke in modern ovens yields appreciable amounts of nitrogen in the form of ammonium sulphate. Thus the fuel saved by the utilization of our water powers means not only a direct fuel saving, but also the conservation of the material from which fertilizers may be produced. The fixation of atmospheric nitrogen by means of electricity is a fruitful field for the utilization of cheap water powers. Mr. Doherty seemed to imply that the investigating engineer is frequently to blame for errors in the construction of hydroelectric properties. This is not so commonly the case, however. Many disappointments have been due to mismanagement and tardy action on the part of others. As to matters dealing with rates of charge, it should be remembered that all electrical supply companies are furnishing not simply energy, but a service as well. The expense in providing this service to each consumer bears no uniform relation to the energy furnished him. Therefore, a charge purely upon the basis of the energy supplied results in unjust inequalities between consumers. Mr. Doane did not concur in the belief that the Scotch type of boilers promises greatest economy for the reserve steam plant. As to the method suggested for insurance against interruptions of service, it would seem to be necessary to consider the time of day or night when the interruption ocurs. In the development of a suitable market for the power the engineer and commercial man must work together. Mr. Doane advocated that complete surveys of every stream capable of yielding power be undertaken by the federal or state governments and that these surveys also include the nature of development necessary in order to secure the maximum power from each stream. In his conclusion Mr. Doane criticized the author somewhat for being too concise and not giving the authority for many of his very important statements.

Dr. Cary T. Hutchinson submitted a written discussion of the paper in which he dwelt particularly on the subject of depreciation of hydroelectric plants as compared with steam-driven plants. The heavy depreciation of the latter is due to the fact that all the machinery used is subject to very great wear and tear and also because the type of steam generating plants

changes very rapidly. The end of the changes in these types has not yet been reached. In modern hydroelectric plants the case is quite different. The construction is of a kind very much less subject to wear and tear, and the efficiency of conversion is much higher, so that there is not such a wide margin for improvements. The depreciation due to obsolescence in the hydroelectric plant should therefore be small. The writer submitted a number of valuable tables, giving first the cost of modern medium-head hydroelectric systems; the depreciation of such a system; the depreciation in detail of the power house equipment, transmission line and substation; interest charges of steam and waterpower generating plants; cost of energy per kilowatt-hour at various annual load-factors, and finally the selling price of the energy from the waterpower plant with six per cent on the investment for profit. In the table of fixed charges which included interest, insurance, taxes, depreciation and obsolescence, the total for the steam plant was given as seventeen per cent, and that for the hydraulic plant as nine per cent. Hydroelectric plants usually labor under a number of disadvantages. The most important one of these is lack of flexibility. Another is the necessity of insuring the continuity of service against interruptions due to low water periods and to possible failures of the transmission lines. This latter requires the establishment of an auxiliary steam plant. To sum up these features it is evident why so many hydroelectric plants have been total failures from a financial viewpoint. In other words, they are so burdened with capital charges and costs that do not enter directly into the productive capacity of the plant that competition with modern steam plants is in many cases rendered impossible. The remedy would seem to be a total change in the methods of financing such propositions.

Harold W. Buck spoke of the general government. There has been a great deal circulated during the past year which has given entirely false impressions about the fabulous value of water powers as they exist in nature. As a matter of fact, a mountain stream in a wilderness itself has practically no value whatever. It is only when it is combined with a very large expenditure of money, ranging perhaps from $100 to $200 per kilowatt, combined with the expenditure of a great deal of brain power, and with much ability in management, financiering and engineering, that this natural geographical situation called a water power has a value. The value only in a smaller degree is contributed by the water, merely falling in its level. When a water power is developed and is successful, it is successful only in a reasonable degree. At the present time, and probably for many years to come, competition will exist with various forms of heat engines. The people have come to believe that a water power is an absolute monopoly. The government also assumes that the water powers will for all time continue to be the only source of power. This hardly semes to be justified. The energy of the water power is merely the converted energy of the sun. It is quite possible that other sources of utilization of the sun's power may develop in future generations. The attitude of the government is such that we are trying to preserve our water powers for the sake of posterity. It may be that when posterity gets here it will not want the water powers at all, and in the meantime we have lost a great opportunity. The government also has adopted a discriminating attitude against water powers as distinguished from other natural resources.

John Martin took up in his remarks the relation of waterpower development to the conservation of our natural resources, speaking particularly of California, where he has spent the last fifteen years in waterpower development work. In that state there are wet and dry seasons—sometimes eight months without a drop of rain—and an engineer must, in order to show wisdom in his installation, install a capacity equal to the minimum flow of the stream. Notwithstanding the difficulties to be encountered, in all the installations he had made he had yet to find the year when they should experience a shortage of water for the installations made. The government is attempting to make charges for the utilization for power purposes of water stored on government lands. When that land is disposed of by the government, its right of control ceases, but it proposes to charge for the use of the water, and thereby conserve the natural resources for the benefit of the people. If it would give the use of the water power away, and would fix a minimum charge for the power, that a company could demand of the people it serves, it would then be conserving some of the rights of the people; but a man securing a water right and wanting to develop a power plant, is like a man who wanted a horse and buggy, and first bought the whip. The greatest difficulty the Californians have encountered in trying to finance their enterprises has been the great desire on the part of greedy capitalists to listen to dishonest reports from engineers, who either do not know or would not tell the truth, and as the result there have been very many failures. As to compensation for interruption of service, Mr. Martin maintained that no hydroelectric transmission plant can afford to assume an uncertain euement of risk on the basis of the calculations Mr. Doherty had stated. If the pole line should break down at midnight and were not repaired until morning, it would be necessary to run the steam plant for the rest of the year for that interruption, which might not have caused the railway company any inconvenience whatever. The question of depreciation is largely a question as to how well the plant is maintained. As to the methods of insuring against interruptions, or lessening the harmful effects of interruptions, Mr. Martin read a communication from Mr. Downing, who told how the large power system is handled.

P. M. Downing, engineer of operation and maintenance of the Pacific Gas and Electric Company, communicated a short description of the load-dispatching system in use by that company. On the load dispatcher rests the responsibility of keeping the voltage normal and seeing that the fluctuations of load are properly taken care of among the different power houses. He has absolute control over the service from each power house and over each transmission line. Without his order no line changes can be made. An important part of his duty is the re-establishing of service after an interruption, with the least possible delay. The system comprises about 1,600 miles of 60,000-volt lines. Trouble on any line is liable to affect the entire system. If the trouble is far enough removed from the stations, the generators may not be thrown out. By the system of switching in use, when trouble occurs the different power houses are immediately separated, leaving one or more running

together with such lines and load as they can carry. A great aid to the dispatcher is a board showing diagrammatically every generating station, substation and transmission line, also every switch in any of these stations or on the lines. The switches are represented by dummies which are adjusted to show whether the switch is open or closed. In a system of the size of the one considered, which has about 125 oil switches and 350 air switches, a board of this kind is an imperative need.

W. M. Ryerson said many of the features connected with hydroelectric plants had been dwelt on before, but this was the first time the whole matter has been treated. As to rates Mr. Doherty cannot mean that it is not legitimate for a supplying company to make special rates for the off-peak business. Regarding depreciation, in the state of Wisconsin the public service commission insists that the public utilities set apart a depreciation fund, and has even ordered a company to raise its rates to provide for this.

Julian C. Smith gave the results of seven years' operation of the Showinigam system. This comprises a system about 100 miles long having two separate pole lines and a large receiving station, where some ninety-five per cent of the power is taken at a voltage of about 50,000. All the power is delivered through synchronous-motor sets. Therefore the interruptions are more numerous than on many other systems. The table gives a classification of both the locations and causes of the disturbances. The main causes of troubles are carelessness or ignorance of operators, lightning, and breakdown of machinery. The number of troubles due to the latter two causes are decreasing each year, however.

D. B. Rushmore stated that he must dissent from some of the opinions expressed in the discussion that water powers cannot be made reliable. Not all water powers are reliable, it is true, but there are water powers with very long transmission lines which are delivering a continuous service which very closely approximates that of a steam station. In the early forms of construction, with long wooden flumes on the side of the mountain, exposed to rolling rock, with long pole lines, depreciating rapidly, the systems were necessarily subject to great interruptions. On the other hand, taking the Great Western Power Company's 100,000-volt plant as an example, since its inception that plant has been practically free from line troubles, as any well-constructed line now ought to be. From the engineering point of view, until we get to pressures above 150,000 volts, and until we get to very much longer distances, there are no engineering features which are going to limit waterpower development and power transmission; but the financial features are the principal points which are of interest in this connection. We all realize that we are going to have governmental supervision of some form with regard to the development of the natural resources, and we are all sure, when this supervision actually comes that we are going to have assistance and not retardation in that development. A small waterpower plant, especially with an uneven load curve, should in the present day never be considered without connection with a steam auxiliary, for a waterpower plant naturally runs best on a very even load, and in almost all cases the load curve shows very great peaks. When we compare hydroelectric installations with steam installations, where we often have complete underground service, we can see that there is always a somewhat weak link in the chain, but that link is being so strengthened that some of the most modern hydroelectric plants are running without more than one interruption in three months, and that is to be considered a very satisfactory service, for in a steam plant we are not entirely free from a shutdown and from disturbances which very seriously interrupt the service, although, fortunately, these do not often occur.

Written communications were also contributed to the discussion by a number of other members, but on account of the lateness of the hour these were referred to by name only. Among these were discussions by H. F. Parshall, of London, England; J. F. Vaughan, of Boston, Mass.; W. H. Gardiner, of New York, N. Y.; H. A. Storrs, of Denver, Colo.; E. C. Brown, of New York, N. Y.; M. H. Collbohm, of Madison, Wis.; J. H. Wilson, of Berlin, N. H.; James Lyman, of Chicago, Ill.; Carl Schwartz, of New York, N. Y.; Clarence P. Fowler, of Edgewood Park, Pa.; Chas. H. Baker, of New York, N. Y.; E. P. Roberts, of Cleveland, Ohio; Robert A. Ross, of Montreal, Canada, and Calvert Townley.

Mr. Doherty was called on to conclude the discussion, which he did by first concurring in Mr. Doane's remarks on the incidental manufacture of ammonium sulphate from the gas producer and coke oven and its use for fertilizer. Such fertilization would provide double the average production of the wheat lands of the United States. One can safely assume that if all our coal were gasified in coke ovens or retorts, it would add at least $500,000,000 to the fertility of our soil, and considerably over $1,000,000,000 to our farm products. As to the seeming discrepancy in his paper, while in one place he had said that below thirty-eight per cent the steam plant operates at lesser cost, and above the waterpower plant at a lesser cost and later that it was possible to put in water turbines, even though they were only run 100 hours each year, it must be remembered that we cannot take our average investment cost for a hydroelectric company, in figuring what we can do in the way of additional installation and equipment, because our main preparation expense is often work on the river, perhaps producing no physical property, or that which cannot be seen, such as the blasting out of a channel or something of that sort. With that type of simple development mentioned, namely, simply a dam across the river and the water flowing directly to the turbine, and from the turbine to the river below, while the total cost for the water power and transmission lines might be as much as $400 per horsepower, perhaps the additional cost of adding waterpower units might not be over $35 a horsepower. Therefore we would have only to figure fixed charges on an additional $35, as the investment for each additional horsepower. The country is now influenced by the belief that our water powers are being controlled, or that an attempt was being made to control these water powers, by a so-called trust. Mr. Doherty has no doubt one can induce the public to abuse anything which it believes is going to result in control by a trust. That is an awful bugaboo, and it is the same with the watering of stock. The public has been taught to believe that the capitalization beyond the actual cost of any property means the watering of stock. Mr. Doherty does not see why the cost of a property need represent its capitalization; he cited a hypothetical case where an investment of $1,000,000 re-

sulted in a plant worth $2,000,000; its capitalization should therefore have been $2,000,000, provided there is no misrepresentation of the facts. On the other hand, if we assume that a thing which cost $1,000,000, and had proven a failure—in fact, had proven its inability to earn interest on a single dollar—we could not contend that it is worth $1,000,000 because it cost that much. In other words, the cost of a thing does not represent its real value. The public has a well-developed case of hysterics over water powers as one of our natural resources and the growing fear that some one would develop these and reap a profit, while very little has been said about the other natural resources, all of which have proved equally or more profitable than water power.

### Plans for Copper Merger.

Plans for the consolidation of the copper interests in which the Guggenheims are dominant have been formally announced.

The Utah Copper Company, which has been one of the largest producers, increases its stock from $7,500,000 to $25,000,000 and becomes the nucleus of a consolidation of the several companies. The stockholders in the Nevada Consolidated Copper Company and the Boston Consolidated Copper and Gold Mining Company will receive shares of the Utah Copper Company in exchange for their present holdings.

The consolidation now effected is the first result of the policy adopted by the big copper producers last summer of making a united effort to keep a better balance in the copper market.

### Morgan Gets Telephone Lines.

In a statement made a short time ago Clarence Brown, counsel for James S. Brailey, Jr., said that J. P. Morgan and Company were the purchasers of the United States and Cuyahoga telephone companies. It has been contended by the independent telephone that the Bell company was purchasing these lines.

### Fire Alarm Service for Los Angeles.

Fire alarm stations and equipment costing approximately $180,000 are either under way or planned for immediate construction in the city of Los Angeles, Cal. A fire alarm system costing $35,000 is to be installed in the University district. A.

## MEAT CURING BY ELECTRICITY.[1]

BY J. C. LINCOLN.[2]

The gentlemen who have interested themselves in the electric meat-curing problem have been working on it for a good many years. After a great many failures, and some successes, it was definitely settled in 1906 that bacon could be cured by electricity in much less time than it was cured by the old methods, and that the cure was certain. In many of the experiments in the preceding eight or ten years some of the meat would turn out very good; some of it would be spoiled. But by the date above mentioned the reasons for the troubles had been discovered and eliminated one by one, and for the last three years the electric curing of meat has been carried on as a commercial process.

In the electric curing of meat wooden tanks are employed. The dimensions of the tanks adopted as standard are fourteen feet long, four feet wide and four feet high, holding approximately 4,000 pounds of meat; different lengths, of course, can be used. At each end of the vat are placed a number of porous cups approximately six inches in diameter, and a little deeper than the depth of the vat. Inside each porous cup is a graphite rod; fastened to each rod is a wire for making electric connection between the graphite electrode and the wire carrying the current from the dynamo to the vat.

The vat and porous cups are filled nearly to the top with ordinary pickle. Electricity, either direct or alternating current, is sent into the electrodes. The current passes through the electrodes into the brine which fills the porous cups. The current passes through the porous cups into the pickle of brine which fills the vat, and through the vat filled with meat to the porous cups and electrodes at the opposite end.

The pickle used in the vat is the same as that used in the old cure; made up with sugar and salt, saltpeter, etc., and is of the same density. In fact, the work has been done with the same pickle that was used in the old-style method, and experience shows that this same pickle is well adapted for use with the electric cure.

The meat is laid in the empty vat between the porous cups in layers, separated by wooden racks, it being necessary to use the racks for separating the meat so that the process of cooling may not be retarded. After the vat is filled with meat packed in this way it is filled with pickle, and the current is turned on. Approximately thirty-five volts at thirty-five amperes is used for a vat of the dimensions given. The meat is left in the electric bath until cured, which in case of bacon, is three to four days, hams twenty-five to thirty-five days, the extra time in the latter case being necessary on account of the thickness of the lean meat.

There is a slight heating effect due to the passage of the current, on account of the electric resistance of the vat, which would tend to increase the temperature of the brine. In order to keep the brine temperature down to about thirty-eight degrees Fahrenheit, a circulation of the brine in the vat is produced, cold brine being delivered at one end of the vat, warm brine flowing off at the other end, flowing through a cooling coil, or into a vat in which is placed a cooling coil. In actual practice the temperatures of the cold brine flowing into one end of the vat, and the warm brine flowing off at the other end, do not differ by more than one or two degrees Fahrenheit.

At the end of the time required for the cure, pickle is drawn off from the vat, the meat is removed, the vat is refilled with new meat, and the old pickle, together with enough of new to bring the pickle up to proper saturation, or to replace what the meat has absorbed, is replaced in the vat, the current is again turned on for another three or four days, and thus the process of curing goes on. The meat itself is washed after being removed from the vat, and is hung up and smoked in the ordinary way, and shipped either in bulk or after being canvassed.

The most noticeable difference between the electric process and the old process of curing meats is in the great saving of time effected by the electric process. This saving of time means, of course, a much smaller floor space required in the curing room in order to handle a given quantity of meat. This, of course, means a decreased investment for a plant in the first place, and decreased amount of refrigeration required, decreased interest on the cost of meat while it is being cured, and decreased overhead charges.

1 Abstract of a paper presented at the third annual convention of the American Meat Packers' Association, at Chicago, Ill., October 18, 1909.

2 A director of the Electric Meat Curing Company, Cleveland, Ohio.

In a general way it is fair to say that the electric curing of meat will enable more than twice as much meat to be handled with the same plant as is handled at the present time. With some kinds of meat, curers can do much better than this. And this means that the items of interest, insurance, plant deterioration and overhead charges will be practically cut in two in a plant using the electric process. Or, to put it another way, a plant with the electric process can handle as much meat as a plant using the present process of twice the size.

A remarkable thing about the electrically-cured meat is its unusual keeping quality. Another peculiar property of electrically-cured bacon is the fact that the flies which lay the eggs which later develop into skippers do not alight on this meat. Experience seems to show that this is the case, but up to this date I am unable to find any satisfactory reason to explain this fact.

Another point of advantage is the fact that the pickle used in the electric process does not deteriorate. I am told that, in the old process, after pickle has been used once or twice, it is thrown into the sewer. At the plant in Cleveland where demonstrations are being carried on, the same pickle is being used which they started with April 1, 1909. This pickle is just as pure and sweet as it was when it was first made up. Of course, some of the ingredients contained in the pickle, such as salt, sugar, etc., are absorbed in the meat, and it is necessary to replace the salt, sugar, saltpeter, etc., in the pickle that has been absorbed by the meat during the curing process. The pickle is renewed in this way occasionally, so as to keep it up to its standard.

Last but not least of the advantages of the electric process is the quality of the meat. A great many of the people who are eating this meat like its flavor better than that of the bacon cured by the old process. The fat in this meat does not frizzle up to the extent that the fat in meat cured by the old process does. The meat has a somewhat fresher taste, and to my palate at least there is more of a nutty flavor.

Additional apparatus required to operate the electric cure is very slight for the ordinary packing house. There are very few packing houses at present in the United States which do not have electric current, and none of them which do not have means for producing refrigeration. The amount of power required by the vat in which meat is being cured is approximately one kilowatt for each vat. Assuming that electric power costs one cent per kilowatt-hour—and this figure is ample unless additional apparatus has to be installed to furnish the electricity for the vats—the cost of operating each vat would be twenty-four cents per day; and for turning out the batch of meat for each vat of three or four thousand pounds would amount to something less than a dollar. The cost of the cooling of the vat during the process of the electric cure would be fourteen cents per day, assuming that refrigeration costs fifty cents per ton per day.

It will thus be easily seen that the cost of the electricity, plus the additional refrigeration, does not nearly amount to the cost of the old process incurred in the loss of pickle and the cost of labor in handling the meat from one vat to another several times during the process of the cure, to say nothing of the decreased size of plant and decrease of overhead charges where the new process is used.

In the discussion that ensued, Mr. Lincoln said that direct current was no longer used in the electric meat-curing process. Alternating current of sixty cycles is now exclusively employed, as this gives no trouble from electrolysis of the pickle as was the case with direct current. The action of the electricity in the process was not completely understood, although the results were positive and satisfactory. There appeared to be a sort of mechanical action tending to drive the pickle into the meat, thus hastening the cure. President Ryan, although not desirous, he said, of advertising any particular process, remarked that as far as the palatability of electric-cured bacon was concerned, a piece of it which he had sampled a month previous, was, in his opinion, as sweet as any bacon he had ever tasted.

## Chicago, Joliet & St. Louis Railway to Enter Chicago.

The Chicago, Joliet & St. Louis Railway Company now holds a license for entry into Chicago and according to newspaper reports will bring passengers into the heart of the city over the tracks of the Metropolitan West Side elevated. This service will probably be inaugurated before the summer of 1910.

## Interstate Railways Company.

Arrangements have been made by the Earle readjustment committee of the Interstate Railways Company to pay the charges and expenses of the Philadelphia Trust Company for acting as depository of interstate bonds under the plan of the former reorganization committee, which has since dissolved. The bonds have been held by the Philadelphia Trust Company, under the instruction of Edward B. Smith & Company, managers, pending the payment of the depository expenses and also the fee claimed by Edward Smith & Company, as managers.

After the depository expenses have been paid by the Earle committee, demand will be made on the Philadelphia Trust Company by bondholders for the release and delivery of their deposited bonds. It is understood that if the Philadelphia Trust Company does not then deliver the bonds that suit will be brought to compel such release. The main object is to cancel the Philadelphia Company receipts now listed on the Stock Exchange, so that the Real Estate Trust Company receipts can be listed.

## System of Accounting for Small Central Stations.

Working with the consent of the Public Service Commission, E. C. Scoebell, chairman of the committee on accounting of the Empire State Gas and Electric Association, has completed a system of accounting for the smaller gas and electric companies of New York State. The committee has evolved a system which is simplified to the needs of the companies that do not need a more elaborate system required by the commission of the larger public service corporations.

The need for this small system was indicated by the announcement that ninety per cent of the gas and electric companies in the state of New York are in receipt of less than a $10,000 yearly income.

## Sale of Quebec-Jacques Cartier Electric Company.

Conditions of the sale of the Quebec-Jacques Cartier Electric Company by the American Light and Traction Company to the syndicate of Montreal men, which is going to run all the public utilities of Quebec under the name of the Quebec Light, Heat and Power Company, have been settled, and the first payment has been received by the American Light and Traction Company.

# THE HYDROELECTRIC DEVELOPMENT AND AUXILIARY STEAM PLANT AT LANSING, MICHIGAN.

## THE SYSTEM OF THE MICHIGAN POWER COMPANY.

The first epoch of a comprehensive plan for the development of the power of the Grand River in the vicinity of Lansing, Mich., is marked by the completion of the first development of several power sites owned by the Michigan Power Company.

In the present hydroelectric development together with the new auxiliary steam plant ample capacity has been provided to serve both Lansing and East Lansing with electric light and power service for the present, but as soon as required by the demands of the increasing power market it is the intention of the company to develop additional power sites which it owns at Dimondale, Grand Ledge, Eagle and Portland, and these will ultimately furnish a total of 18,000 horsepower when fully developed to their normal capacity.

## HYDROELECTRIC PLANT.

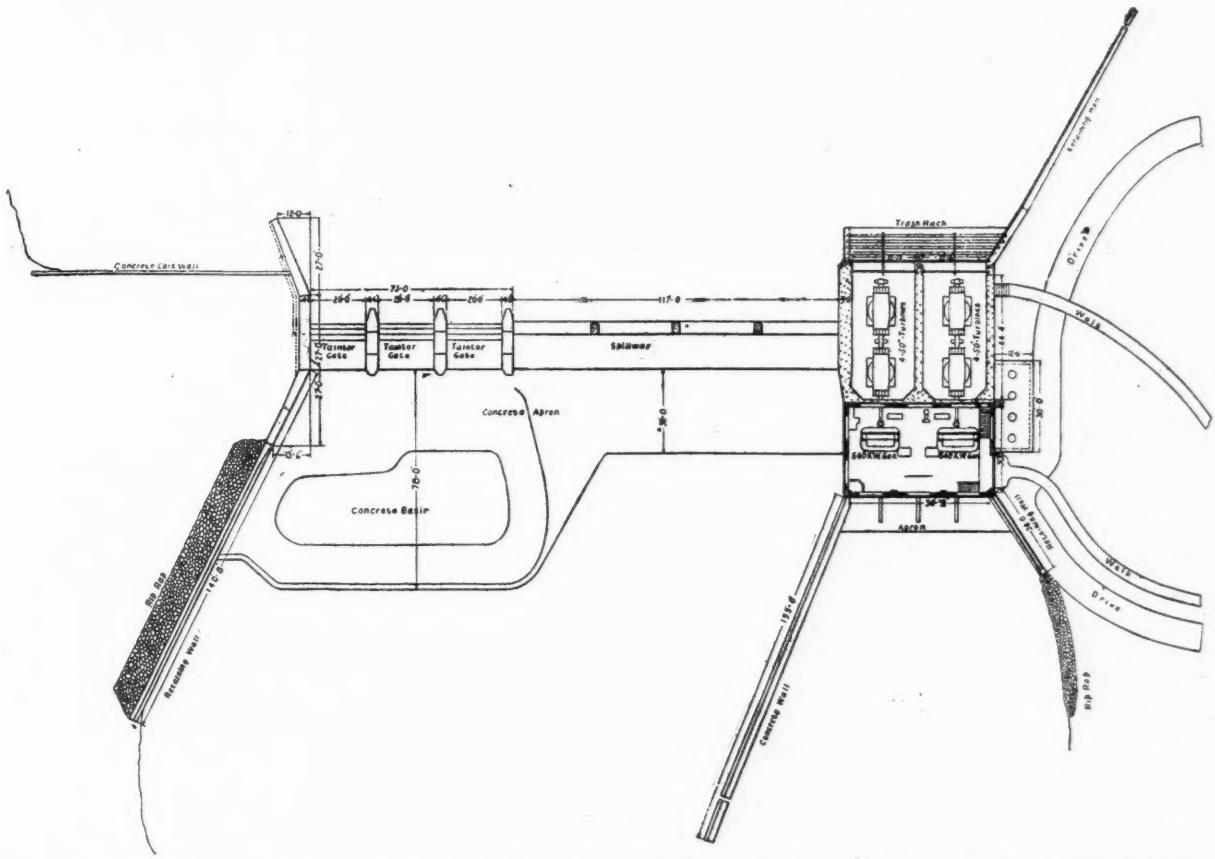
The hydroelectric development described in this article is located one and a half miles up stream, but within the city limits of Lansing and not more than a half dozen blocks from a connected load which nearly equals the total capacity of the plant.

By the construction of a fifteen-foot dam at this point there was created a reservoir nine miles long with an average width of about 1,000 feet. The expense involved of overflowing several hundred acres of valuable river bottom lands was considerable and in addition to this it was found necessary to raise several steel bridges and approaches to the same. However, the improved boating facilities above the dam and the creation of practically constant water level have met with the hearty approval of the abutting property owners.

The construction of the dam is of solid monolith design with steel reinforcing where necessary. It is built upon a solid rock foundation which was found quite close to the surface of the river bed. The dam contains a spillway 100 feet long and three twenty-foot tainter waste gates located at one end. The power house is located at the opposite end of the spillway. Earthen embankments with concrete walls extend from the waste gates at one end of the dam and from the power house at its opposite end to the high ground on either side of the river, making the complete dam 600 feet in total length.

A steel foot bridge is constructed across the spillway to facilitate reaching the gate operating mechanism and for the accommodation of the public in crossing the river. The flood gates are hand operated, but can be easily handled by one man. A reinforced concrete apron extends seventy-eight feet downstream from the waste gates and thirty feet from the toe of the spillway and effectually prevents the undermining of any part of the dam. Concrete walls are provided to prevent the discharge from the waste gates washing the banks and to divert the waste water from the tail race during the flood seasons.

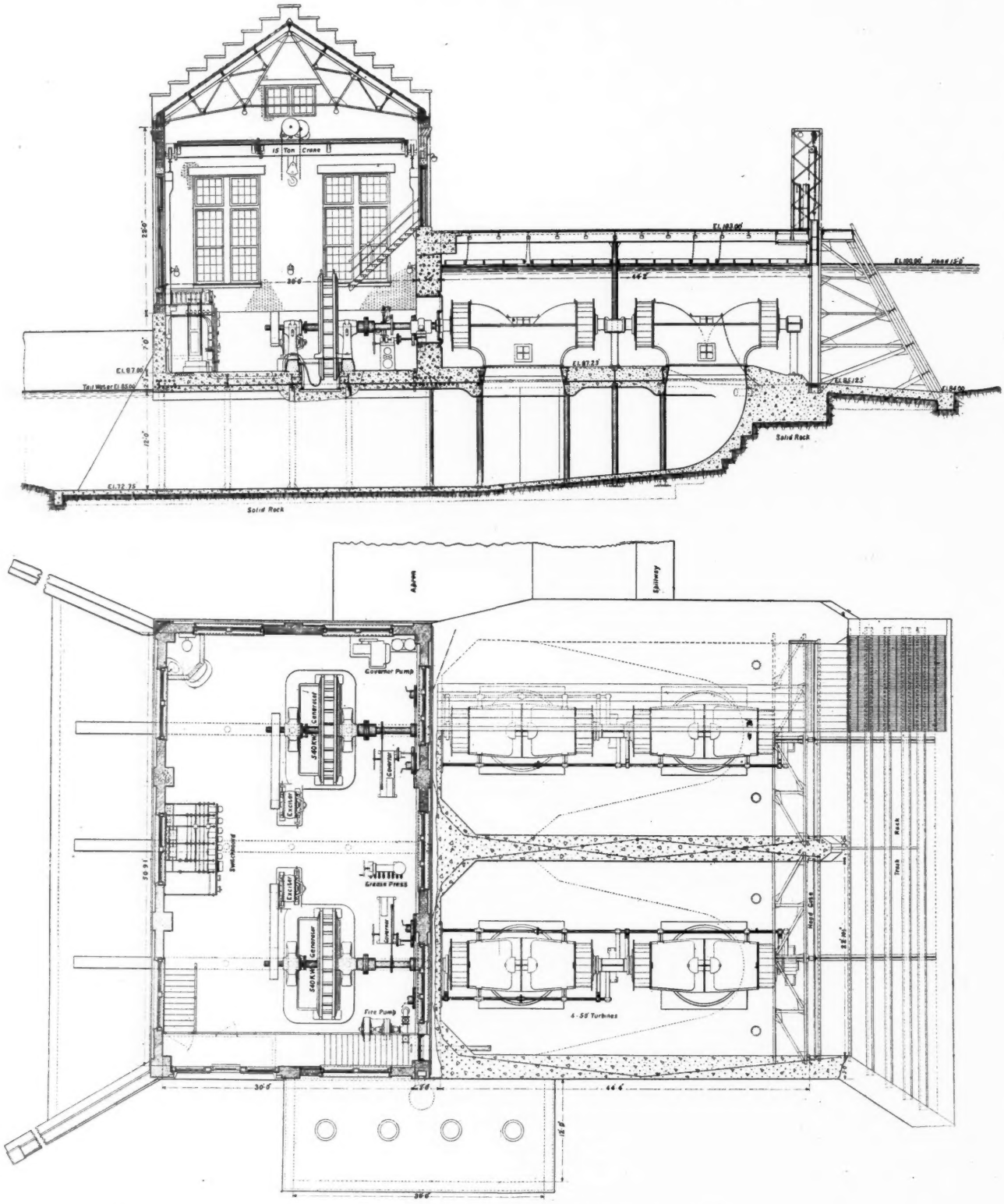
The power plant building is constructed of reinforced concrete to a height well above high water, the superstructure being pressed brick with a




PLAT OF THE HYDROELECTRIC DEVELOPMENT, INCLUDING THE DAM AND POWER HOUSE, OF THE MICHIGAN POWER COMPANY, AT LANSING, MICH.

steel-trussed tile roof, the whole combination presenting an attractive appearance. The power house is provided with a fifteen-ton hand-operated crane.

In the plant the power equipment consists of two duplicate waterwheel units placed in separate compartments from either of which the water can be withdrawn to facilitate making repairs or inspection without interfering with the operation of the other unit. Each unit consists of four fifty-inch Samson horizontal turbines set in pairs, each pair with a center discharge. Each pair of wheels is fitted up with a counterbalance flow which effectually prevents air from being drawn into the turbines during low water, and at the same time




CROSS-SECTION AND PLAN OF HYDROELECTRIC PLANT.

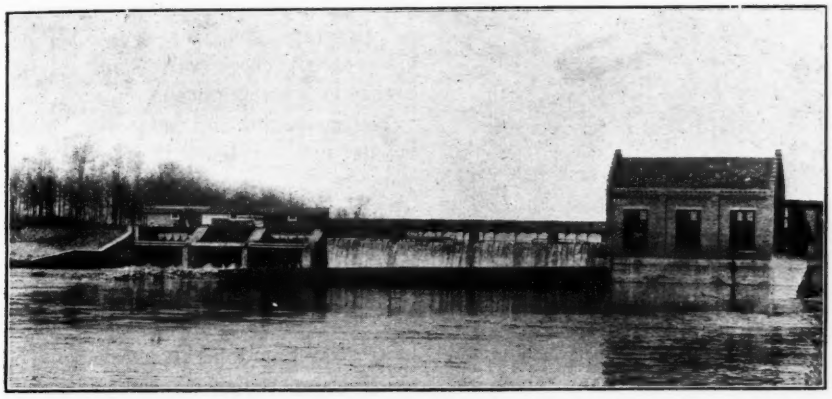
does not interfere with the flow of the water into the turbines. Each unit of four turbines is connected by a nine-inch shaft to a 540-kilowatt, 4,000-volt, star-connected with grounded neutral, sixty-cycle, three-phase, revolving field, General Electric alternator, operated at a speed of 120 revolutions per minute. Each group of turbines is capable of delivering 1,000 horsepower with a normal head of fifteen feet.

Each unit has its speed regulated by a Lombard oil-type governor, the two governors being supplied by one induction-motor-driven triplex pump. Each governor is equipped with an electrically operated synchronizing device controlled from the switchboard. The turbine gate shafts are equipped with pin clutches by means of which the gates of either pair of wheels can be closed, thus making it possible to operate the remaining pair of wheels during light loads at more nearly their full capacity and thereby increasing the efficiency of operation. The waterwheel shaft bearings are lubricated with grease which is forced through an individual pipe for each bearing by means of a grease compressor located at a convenient point in the generator room.

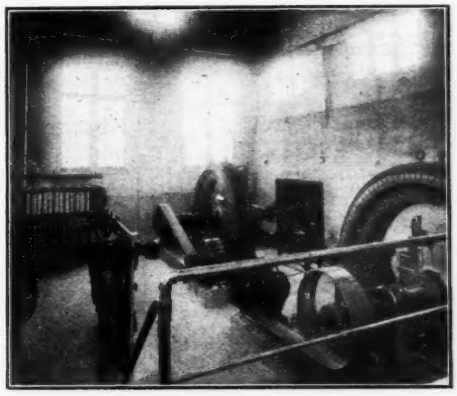
The lower parts of the generator frames are protected from any possible leakage into the generator room by steel pans constructed to fit the inside of the generator bases and which extend to a height of twelve inches above the floor line. All cables are encased with lead and made moisture proof and run through iron conduits, all ends of which extend ten inches above the floor line, thus preventing any possible damage by water on the generator room floor.

The switchboard is of standard construction and supplied with a full complement of instruments and meters. There is an equipment of oil switches and a Tirrill voltage regulator. The high-tension bus-bars are provided with a bus-tie switch located so that each generator can be operated on entirely independent circuits if desired.

The accompanying illustrations show the general construction of the plant. The head gates are made in sections and can be easily handled by one man by means of a small traveling hoist mounted on a permanent steel track. It will be noticed that the two units are arranged with their shafts parallel to the stream, this being found necessary to avoid dismantling an old steam auxiliary plant, which had to be kept in operation during the construction of the new hydroelectric plant.

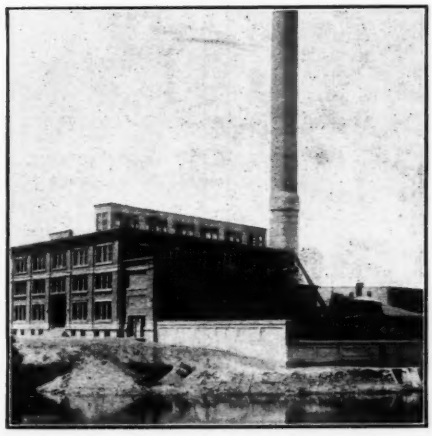


DAM AND HYDROELECTRIC POWER HOUSE, LANSING, MICH.



INSIDE THE GENERATOR ROOM.

A feature of the design is the structural steel-work of the penstock and generator room floors which with its supporting columns practically carries the entire load, the reinforced concrete acting merely as a filler and protection for the steelwork. The safety and reliability of this plant have been shown by several months of very satisfactory service, during which time some severe tests have been imposed.



GENERAL OFFICES AND AUXILIARY STEAM PLANT.

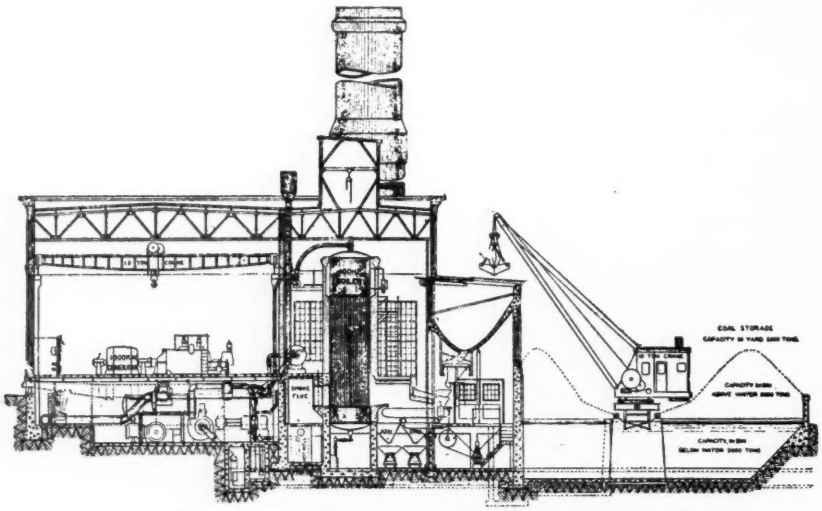
AUXILIARY STEAM PLANT.

The flow of the Grand River is subject to extreme fluctuation, and although the low-water period during some years is of very short duration, yet it has been found advisable to provide auxiliary steam power up to a capacity of about three-fourths of the normal rated capacity of the waterpower development, and in addition thereto, to provide sufficient steam plant capacity to take care of the increase in the power demand until such a time when the growth of the power market reaches a point where the investment in an additional hydroelectric development will prove to be profitable.

The company's new steam plant is located on the river bank at the foot of Ottawa Street within two blocks of the center of the business district of Lansing. In addition to serving as an auxiliary electric generating station, the steam plant furnishes steam for a central-station heating system covering the entire central district of the city west of the river. When it is found necessary to supply electricity from the steam plant during the heating season one or more steam turbines are operated non-condensing and exhaust directly into the steam-heating system with a back pressure varying from four to six pounds per square inch, except, however, during times when but a small amount of steam is required, in which case steam from the auxiliaries is used for supplying the heating system. If this is insufficient, additional steam may be taken from the intermediate stage of one or more turbines through connections provided for that purpose, and each of these turbines kept in operation in connection with its condenser. The company is now supplying steam heat for about 175,000 square feet of radiation and this service has proven to be

a very profitable branch of the company's business.

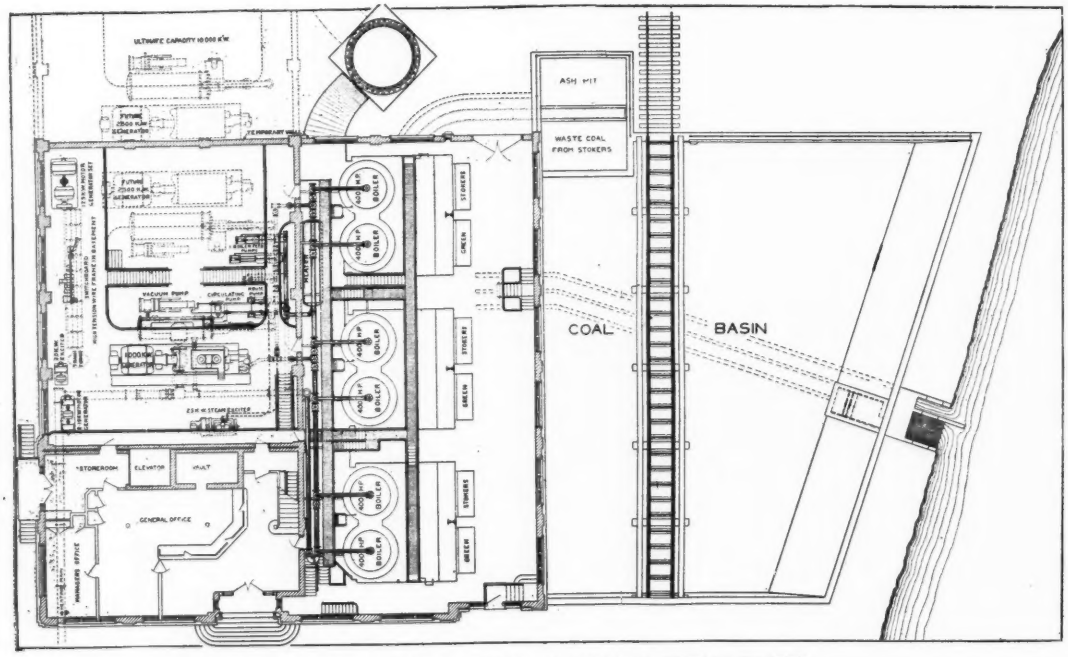
The steam power plant building is a substantial concrete steel and brick structure and is entirely fireproof. The exterior is faced with chocolate-colored paving blocks trimmed with concrete. The concrete cornices and belt courses are provided with electric lighting conduits laid in the concrete with appropriate openings for receiving incandescent lamps, thus providing excellent outline lighting, which has proven to be very attractive and forms a valuable advertising feature in connection with the boosting of the electric lighting business. The front of the power house has the appearance of a four-story office building. Two floors of the front end of the engine room are devoted to the general offices of the company and the lower and upper floors for store-room purposes. The building is supplied with elevator service and all the usual conveniences, including a shower bath for the use of power station employes.



CROSS-SECTION THROUGH AUXILIARY STEAM PLANT.

Throughout, the power house and its equipment are designed for future extension to an ultimate capacity of 10,000 horsepower. At present there are six 400-horsepower Wickes water-tube boilers, equipped with Green Engineering Company chain-grate stokers; this combination of boilers and stokers is found to be absolutely smokeless. The boilers and piping are constructed to operate at 165 pounds working pressure, but the piping is arranged for operating any number of boilers at low pressure if desired, valves being provided for dividing the steam header at any suitable point. A six-inch auxiliary steam header is provided and constructed to form a loop in connection with the main ten-inch header. Condensation from the high-pressure piping and steam separators is automatically returned to the boilers by means of the Damon-Zimmerman patented system, in which no pumps, traps, steam loops or other devices except check valves and piping connections are required.

The smoke flue and connections to the boilers are constructed of reinforced concrete built in sections and provided with proper expansion joints to prevent cracking. The design of the smoke connections with easy bends and baffles for properly distributing the gases in the flue, represents improvements which have been found highly efficient. The chimney is 203 feet in height above the boiler-room floor, twelve feet in diameter and of reinforced concrete construction. All boiler-feed water passes through a Wilcox automatic water weigher and all coal is discharged into a traveling scale hopper and is weighed before being burned, thus making it convenient to conduct continuous boiler tests.




PLAN OF GENERAL OFFICES AND AUXILIARY STEAM PLANT.

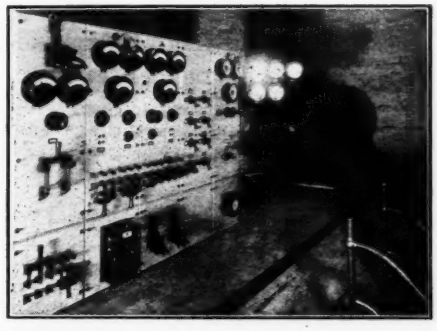
A novel feature of the design of this plant is the method of delivering coal into the elevated coal bunkers. This work is done with a locomotive crane which is provided with a special forty-four-boom and is capable of hoisting coal at the rate of twenty tons per hour directly from coal cars or from the submerged storage basin and delivering it into the elevated bunkers without the use of conveyors, or other auxiliary apparatus.

This same locomotive crane also

serves for handling the ashes after these have been delivered into the ashpit shown on the accompanying plan. Ashes are taken from the steel hoppers located below the stokers by small steel cars operated on a narrow gauge track and automatically delivered into the ashpit mentioned above. This system of coal and ash-handling apparatus has proven to be very satisfactory and has many advantages over any other system. The submerged coal storage basin has a capacity below the water line of 3,000 tons and about an equal amount of coal can be stored in the basin above the water line. The efficiency of storing coal submerged in water has been found by several authorities to amount to an average saving of about six per cent in addition to which advantage there is absolutely no possibility of spontaneous combustion.

The first 1,500-kilowatt maximum capacity Westinghouse-Parsons turbo-generator unit equipped with a C. H. Wheeler surface condenser with steam operated auxiliaries, has been in service several months and has been found to operate very satisfactorily when exhausting against a back pressure of from four to eight pounds, and it is capable of developing more than its normal rating of 1,000 kilowatts under these conditions. A 2,500-kilowatt normally rated Westinghouse-Parsons turbo-generator unit, capable of developing a maximum of 3,750 kilowatts, is now being installed in connection with a Westinghouse-LeBlanc condenser.

In addition to the main generating units there is also in operation one motor-generator set, consisting of a 225-horsepower, 4,000-volt induction motor and a 125-kilowatt, 600-volt, direct-connected generator for supplying a group of 500-volt elevator motors which are located in the vicinity. There is also a forty-five-kilowatt motor-generator set, consisting of a 440-volt induction motor driving two 22.5-kilowatt, 125-volt generators connected to a three-wire system, supplying a circuit of small direct current fans and motors.

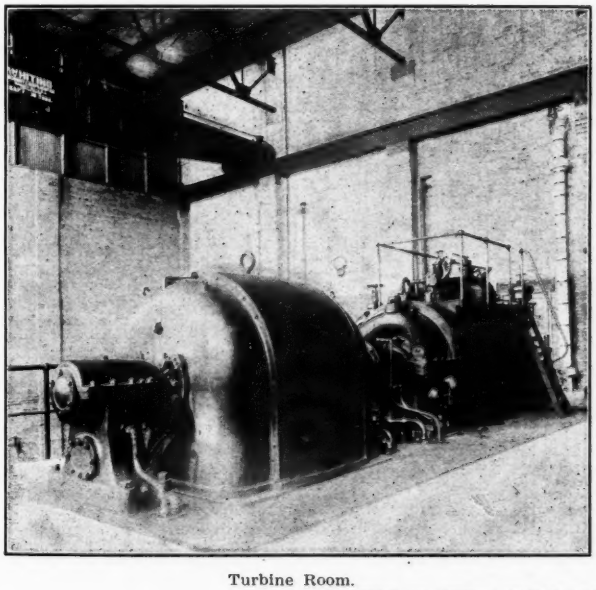


SWITCHBOARD AND MOTOR-GENERATOR IN AUXILIARY STEAM PLANT.

The switchboard consists of six standard marble panels containing all necessary instruments, meters, Tirrill voltage regulators and switches, also circuit-breakers for the direct current circuits, and one panel containing remote-control switches and signal lamps. All 4,000-volt alternating current switches are of the solenoid operated oil type and are mounted on a steel framework located in the basement below the main switchboard together with all series and potential transformers and field rheostats. The small wiring of the switchboard is practically all run in conduit, and all generator and switchboard cables are lead-covered and taped with fireproof tape. All outgoing circuits, both alternating and direct current, are run underground from this plant to the fire limits of the business district.

The engine and generator room is served with a fifteen-ton hand power traveling crane. The entire plant is provided with ample and permanent iron stairs and runways providing easy access to all parts of the equipment. The coal bunkers are of the suspended design constructed of reinforced concrete. The openings over the bunkers are closed or opened with an operating device from the boiler-room floor.

The construction of both the hydro-electric and steam auxiliary plants of this company was done on force account under the supervision of and from plans and specifications designed by W. H. Zimmerman, consulting engineer, First National Bank Building, Chicago, who was also general manager of the property until its completion.



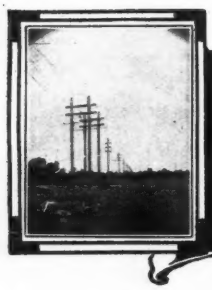
Turbine Room.

Boiler Room.

VIEWS IN THE AUXILIARY STEAM PLANT AT LANSING, MICH.

### Municipal Plant Loses Money.

The municipal electric-lighting plant at Grove City, Pa., shows a deficit of $1,433.11 for the first year of its existence from October, 1908, and this notwithstanding the payment of $3,600 by the borough itself for sixty electric lights. The initial cost of the plant was $25,000 which was borrowed at five per cent. The expenses for the year totaled $5,990.10, the receipts $4,556.99.



# CENTRAL-STATION PRACTICE

## Transmission—Interior Wiring.

## A 2,750-VOLT DIRECT-CURRENT SYSTEM.[1]

BY A. H. BARRINGER.

The transmission of energy becomes a remarkably simple matter when direct current is employed, and given that the generators, rotary transformers, and apparatus could be brought to a sufficiently high voltage without the cost becoming prohibitive, and that they could be guaranteed as reasonably reliable and durable, then undoubtedly direct current would be an ideal agent. But the difficulties have proved so many, and the risks of installing such plants so formidable that, except for a few isolated instances, direct-current systems of any size operating at over 1,000 volts are practically unknown. Moreover, the results obtained from the few in operation can scarcely be called inviting enough to encourage such enterprise in this field.

Before going into details of the particular system under review, it may be as well to give a brief description of the district which it is operating.

Twickenham is one of the southwestern suburbs of London. It is chiefly residential, as are the other towns along that part of the Thames, and, except for a few sawmills and the like, and the National Physical Laboratory, there are no power users. This lack of day load is probably what influenced the designers to run direct current in the first instance. Twickenham is so scattered that there has been constant trouble in keeping the low-tension network balanced and up to standard pressure. The area supplied at present is about twenty-five square miles, but the company has powers which will eventually treble that total.

The low-tension mains, comprising about sixty miles of complete three-wire, are all linked up into one network, fed at suitable points by rotary transformers, and, of course, largely from the central. The generating station is situated in about the center of Twickenham, about two miles from one end of the district now operated, and between six and seven miles from the other. The transmission is by direct current at 2,750 volts, with future intentions of making it three-wire at 5,500 volts.

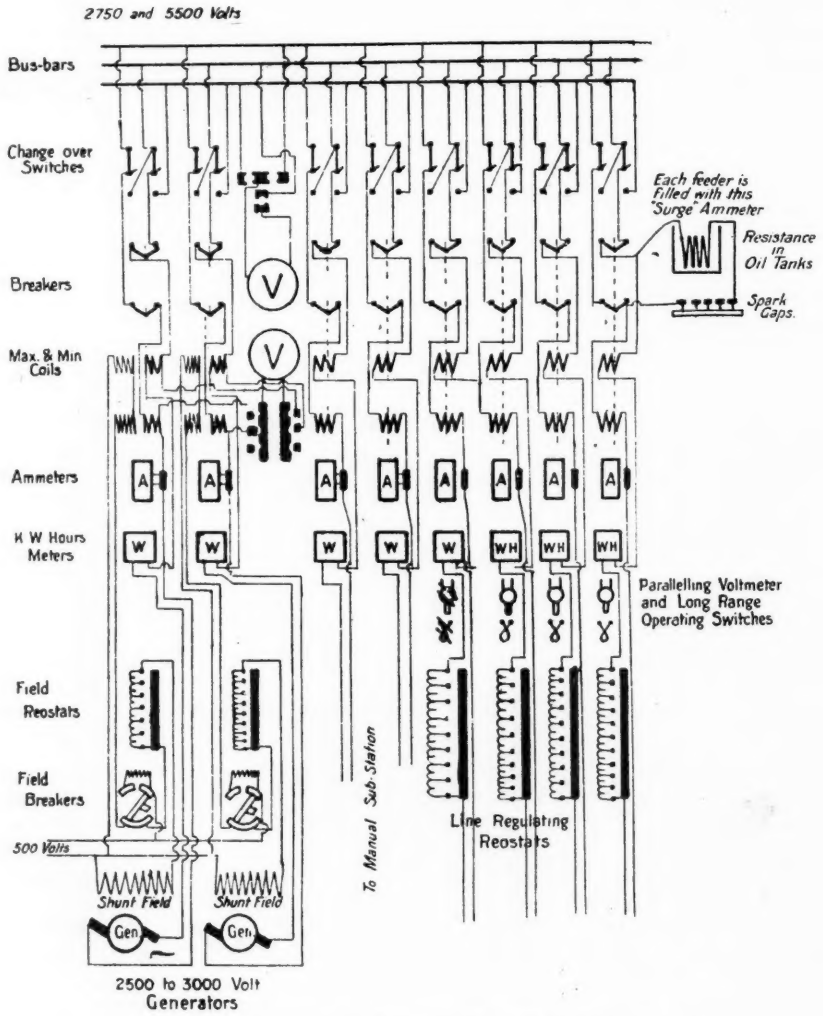



FIG. 1. SWITCHBOARD AND GENERATOR ARRANGEMENT.

*Generating Station Equipment.*—The present high-tension equipment consists of two 200-kilowatt, 2,750 volt generators and one 100-kilowatt, 2,500; 500-volt, rotary transformer, with booster attached for raising the low-tension side for transforming up, so that whilst during the day one high-tension set is run, supplying the two principal substations and the home rotary transformer, during heavy loads the home rotary transformer is taking current from the low-tension board and transforming up. This has saved installing another generating set.

*Generators.*—The generators are four-pole, direct-current, running at 475 revolutions per minute. They are shunt wound, with shunt separately excited at

1 A paper read before the Electrical Section of the Canadian Society of Civil Engineers, December 9, 1909.

50 volts. These machines have now been running for about five years, and it is a curious fact that, although they have continually been in trouble from flashing over and other causes, the armatures have never had even a new former. For two years each machine was running without a break for eighteen hours on each alternate day.

*Switchboard.*—The switchboard (Fig. 1) consists of nine panels. They are of iron throughout, with mica washers and bushings. There are two generator panels, six feeder panels, and a voltmeter panel. The circuit breakers are double-pole air-break, and are ranged along the top, with a slate division between each set. Immediately behind are the change-over switches, and above these the bus-bars. The generator switches are fitted with maximum and minimum cut-outs, the minimum coil being fed from the 500-volt shunt circuits. The feeder cut-outs are simple overload. At the bottom of the generator panels are the field rheostats and field breakers. Five of the feeder panels are fitted with line-regulating resistances, long-tension operating switch, and paralleling voltmeters for running the automatic substations. The method and connections are shown in Fig. 2, and will be referred to later. Each feeder is fitted with a surge arrester, consisting of a series of spark gaps in series with an oil tank resistance. These arresters were installed after one of the lines had been twice broken down on charging. Lastly, the voltmeter panel, which, as will be seen from the figure, has two electrostatic meters, and a plugging arrangement for paralleling and for plugging on to the three bars.

*Transformers.* — The rotary transformers (Fig. 2) are two-pole machines of overtype design, with double-wound armatures running in a single field, and have copper brushes. They run 500 revolutions per minute, and have a fixed ratio of 5 to 1. The regulating is done by the resistance in the high-tension circuit. They are started up as series motors, and for this purpose are fitted with a small series field, which works in conjunction with a short-circuiting switch. The actuating solenoids of this switch are connected in series with the shunt-field circuit, which in its turn is connected straight across the low-tension end of the transformer. These switches are so adjusted that, when the low-tension pressure equals about 450 volts, the series field is cut out. The transformer bearings have small oil pumps working off a cam on the shaft ends, as well as the usual oil rings. These oil pumps have proved somewhat of an expensive luxury, as will be shown later. The figure is of the home transformer, and shows the method of attaching booster necessary to make up-transforming possible.

*Substations.* — There are at present four substations, and these form what is perhaps the most interesting part of the system. One of them, the Teddington, is a manual, equipped with two 100-kilowatt transformers, high-tension and low-tension switchboards, and a 1,000 ampere-hour battery. This is arranged after the same pattern as the generating station, but it is the automatic stations which will most likely prove the more interesting. Each of these is equipped with a transformer of 50 or 100 kilowatts, a set of balancers worked by a time switch, and a distance-operated, single-pole, low-tension circuit-breaker. The only high-tension apparatus is the short-circuiter and a pair of switch fuses for isolating purposes. The Molesey station differs in that it has a 600 ampere-hour battery and a small low-tension switchboard, but it is so arranged that it is worked automatically with the battery floating. A man cycles out every morning to put the battery on charge, and again in the afternoon to take it off. The other stations are visited only about two or three times a week.

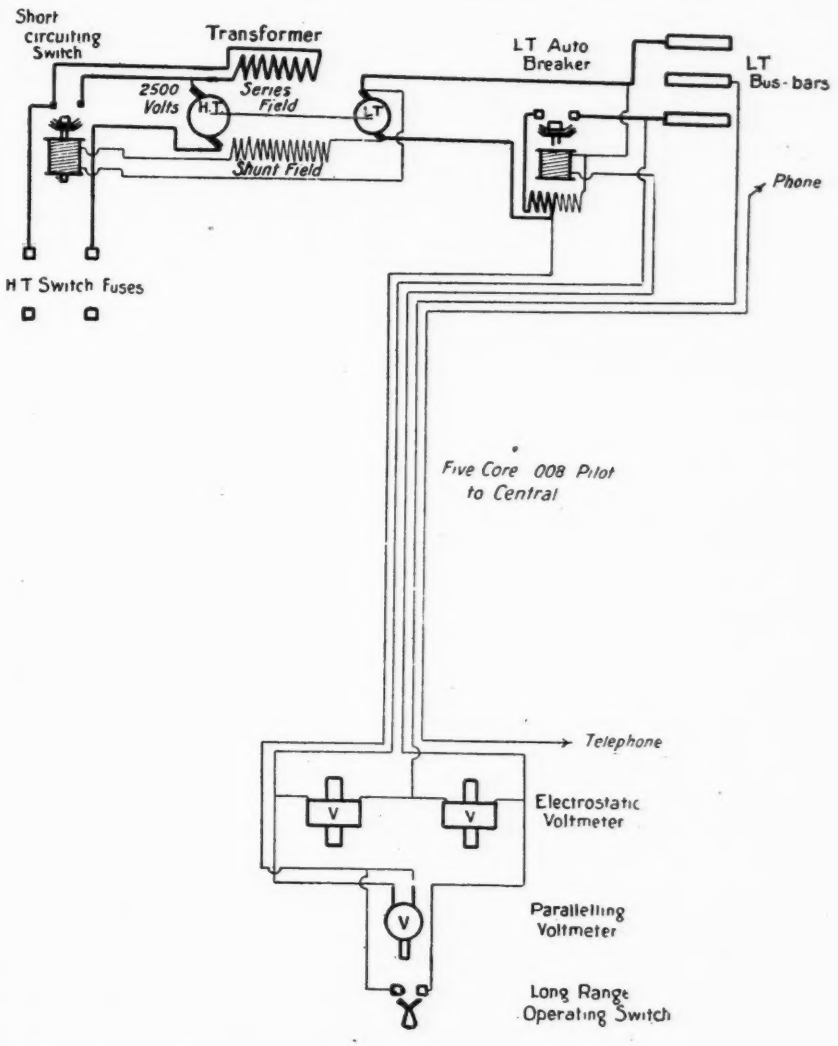



FIG. 2. SUBSTATION ARRANGEMENT WITH OPERATION FROM CENTRAL.

The regulation of these stations is done from the central by means of the line resistance, and for starting up, etc., a five-core .008 armored pilot cable is run back from each (Fig. 3, substation arrangement). Coming to the method of connection, it will be seen from Fig. 2 that the actuating solenoid of the low-tension auto is connected from the opposite pole of the transformer and

through the "firing switch" at the central. From the firing switch another line is run back to the transformer side of the auto. Being on this side is important, as, were it on the other side, the switch could be operated whether the machine was running or not. As it is, when the machine is shut down there is no potential across the firing switch. This same line also serves for the paralleling voltmeter, whilst for the other side of this meter another line is taken from the busbar side of the auto. Across these lines the electrostatic pilot voltmeters are connected, the fourth line in the cable serving for their neutral and the fifth for the telephone.

*Some Operating Troubles.* — Taking the substations first, the most frequent cause of trouble has been the high-tension brushes. These, as has been explained before, are copper, and when the commutator gets rough they have to be literally soaked with oil to prevent them wearing down between visits. Sometimes, too, they slip. Except for burning up the brush holders, this never does any actual damage, and it is amusing to note that invariably the first intimation of such a state of affairs is received from a policeman, hastily despatched by the alarmed residents in the neighborhood. So far as actual damage is concerned, the oil pumps and the low-tension autos have been the worst offenders. The weakness in the oil pumps is a sight glass fitted on the pipe leading into the bearing cap. These glasses occasionally crack, the oil is pumped out onto the floor, and central is probably notified by the breakers coming out through the shaft seizing.

Coming to the switches, it is necessary first to give a description of their action. The solenoid plunger operates the switch through a ratchet and pawl arrangement. When thrown in, the switch is held by contact friction, the exciting current is broken, and the plunger falls back to its original position. Next time the solenoid is excited the switch is pulled out, and so on alternately. The trouble is the pawl springs. These are only light spirals, and often break. When this happens the switch is only partly throw in—to be exact, just into the carbon ends. Naturally, in a short time the switch resembles an arc light, and, unless the operator notices the jumpy or falling load, he is not aware of anything untoward until the policeman arrives or the switch burns out.

Then there are the short-circuiting switches. These are designed to fall out by gravity when the machine is shut down, but occasionally they will stick up, and then the machine cannot be started until someone is sent down to pull it out. Another peculiarity of these switches is sometimes in evidence on starting up. If the pressure is higher than usual, or the starting resistance is cut out too quickly, the inductive effect set up by the series field is so considerable that a surge is started in the shunt, and the short-circuiting switch is thrown violently in and out for twenty, or perhaps thirty, times before the machine begins to revolve.

There are six transformers installed, and whilst being subjected to all manner of strain through short-circuits, etc., they have never been known to flash over. This may be due to the copper brushes. The chief trouble found with them is in the armatures and series coils. The latter, unless kept scrupulously clean from copper dust, are liable to break down to earth. So far the system is not grounded on one side, and on one occasion the series field of an outlying transformer broke down to earth when the other side of the system was grounded in one of the generator ammeters. The writer's head was about three feet from the ammeter when it went, and the resultant display has founded a lasting impression.

There is one transformer in particular which seems to have an unfortunate penchant for discharging across the field air-gap. The armature has been twice burnt out, probably through this, and the last time it was rewound it discharged so badly that it could not be run. There was a continuous stream of sparks right along the armature tunnel. It was found that the only measure to stop it was a coat of insulating paint on the pole-pieces. A standing menace which has been active on one occasion is the danger of losing the shunt-field. This has been provided for in so much that it is made foolproof by dispensing with lifting attachment on the low-tension brushes. What is likely to happen if the field is faulty was seen on the home transformer on the first starting up of the plant. Somehow a faulty connection in the shunt-field circuit was overlooked, and when the current was switched on the machine built up in speed until the binders burst. An idea of the speed attained may be gathered from the fact that when the current was switched off the armature took well over five minutes to come to rest. Pieces of the debris were found on top of the crane.

A serious drawback to these transformers presents itself in time of mains trouble. The low-tension network pressure is 480 volts, and, in time of a bad short-circuit, this may fall as low as three, or even two hundred, volts. The transformers will not come down as low as this, and to switch them in at, say, 400 volts is simply to throw the breakers out. The only way is to catch them speeding up, but then the series field is not cut out. Once, in very desperate straits through a dead short on an 0.5 feeder, a transformer was switched in in this manner as a last recourse, in the hope that the short-circuiting switch would act on load. But the hope was misplaced. In five minutes the machine was on fire, and the fire brigade was down squirting chemical extinguishers over it.

Coming now to the generators, as has been previously stated, the chief trouble is in commutation. This remark must not be misunderstood, for, when every thing else is right, the commutation leaves nothing to be desired. But it is when there is outside trouble that the generators behave badly. A transformer burning out, or a short-circuit on the mains, and sometimes even a big jump in the load, will cause them to flash over. Beyond burning off a belt or pitting the commutator no harm is done to the machines. But it is awkward in other ways, for if two machines were running in parallel, and one went, undoubtedly the other would go too. As was remarked earlier, it is the intention in the future to run it as a three-wire system, with two machines in series, and if ever that is tried the results will be very interesting.

The switchboard has not so far given any trouble, except for voltmeter panel blowing out. At first there was a little difficulty in breaking the shunt-field current. The switches are single-pole, and threw a high resistance across the shunt when breaking. They are enclosed in an iron frame, and the arc on breaking would sometimes ground the low-tension system. Finally, after an operator's arm had been burnt, they were inclosed in asbestos boxes.

Summing up, the most inefficient part of the system is in the method of regulation. When, as is nearly always the case, one station is taking a comparatively heavy load, then the high-tension pressure must be run 100 or 200 volts higher than would suffice for the other

stations. Consequently, this energy has to be absorbed in the regulating rheostats, and entails a very serious loss. Apart from this, the transformer efficiencies are very high.

Finally, a word on the mains. These are, of course, in all cases underground, and, except for the troubles referred to, due to the surging, there was only one fault developed on the high-tension system in five years. The cables are 0.5 two-conductor concentric, paper-insulated, with lead sheath and outer steel wire armoring. The method of laying is to draw them into earthenware conduits. They cannot be spoken too highly of.

Perhaps, though it is foreign to the paper, a few concluding remarks on the low-tension system of mains will be allowed. The experience with these has been so remarkable that it is felt to be justified, and, as underground mains seem destined to come on the tapis here sooner or later, it may prove of interest.

The low-tension mains are of what is known as the solid system. The cables are coated with vulcanized bitumen, the only other protection being a covering of thick braid. They are laid in wooden troughs, supported on wooden bridges, the troughs then filled solid with bitumen, and a layer of tiles put on top.

These mains have been an endless source of trouble. The troughing rots, the bitumen cracks, and the water gets through to the cables. Sometimes a "short" will burn away as much as fifty feet of cable. But the most remarkable thing is that the mains have been opened and not a vestige of copper found for as much as eighteen feet, yet at the same time a motor had been working beyond the break.

There have been as many as three breakdowns in a day, and for a year the average mains faults have not been less than four a week.

### Electropneumatic Dispatch Tubes.

The Italian Government is having installed in each of the cities Rome, Naples and Milan, a system of pneumatic dispatch tubes to connect the railroad station, stock exchange, and general postoffice. Each of the installations is to be operated by electric motors and air compressors, a duplicate power plant being provided in every case to act as a standby. The leading Italian cities have always been very progressive in establishing systems of quick interchange of mail parcels.

### Heat Losses in a Power Station.

In a paper by F. H. Carson, entitled "An Investigation of Heat Losses in a Power Station," published as an excerpt from the proceedings of the Institute of Civil Engineers for the past session, particulars were given of the heat losses in a works comprising two stations, each of 2,300 kilowatts capacity, and run in conjunction with each other. One station, says *Engineering News*, has nine high-speed, reciprocating, direct-current units of 120 to 550 kilowatts capacity, three similar alternating-current units of sixty to 200 kilowatts capacity, six Lancashire boilers with sprinkling stokers and two economizers. The second station has three 775-kilowatt, high-speed, reciprocating-engine units, six Lancashire boilers with sprinkling stokers, etc. The tests reported were made during 168 hours in November, 1907, and the heat balance is summarized as follows:

| | British Thermal Units. | Percentage. |
|---|---|---|
| Heat energy in the coal (as used) | $6,287 \times 10^6$ | 100 |
| Converted into useful work | $339 \times 10^6$ | 5.39 |
| Rejected to chimney | $842 \times 10^6$ | 13.36 |
| Radiation and leakage from steam pipes | $135 \times 10^6$ | 2.15 |
| Rejected in hot ashes (combustibles) | $256 \times 10^6$ | 4.07 |
| Losses (net) by auxiliary processes | $189 \times 10^6$ | 3.10 |
| Rejected (net) in condensing water | $3,187 \times 10^6$ | 50.62 |
| Rejected by blow-down valves of boilers | $8 \times 10^6$ | 0.13 |
| Evaporating and superheating grate jets | $87 \times 10^6$ | 1.38 |
| Losses unaccounted for (radiation of boilers, brickwork, including errors of observation) being balance | $1,244 \times 10^6$ | 19.80 |
| Total | $6,287 \times 10^6$ | 100.00 |

### Mechanical Stokers Utilize Cheap Fuels.

In his recent presidential address to the Leeds Local Section of the (British) Institution of Electrical Engineers, W. M. Rogerson had the following to say on the subject of mechanical stoking:

"As far as the boiler house is concerned, probably the most notable fact is the lower and cheaper qualities of bituminous coal that are now being burnt, and this is attributable to the great success of mechanical stokers. With hand firing it is not practical to have a longer length of grate than seven feet, but with mechanical arrangements grates can be made as long as ten feet and even fourteen feet, so that with low grade and dirty fuel the exaporation possible with a high grade fuel can still be maintained."

### Record-Breaking Copper Production.

According to the November report of the Copper Producers' Association, some records for copper output are again broken. Production in November was at the rate of 4,053,945 pounds daily, as compared with 4,021,216 pounds per day during October, making a total monthly production of only about one per cent lower for November than for the longer month of October.

The exports for the month of November were 55,266,595 pounds, which were from 15,000,000 to 20,000,000 pounds in excess of European consumptive requirements, possibly more, as some copper went into warehouses on the Continent. During the current month the exports are likely to be even larger.

### Calcium Carbide Factory in Mexico.

Calcium carbide for lighting purposes will form the chief product of the chemical and steel works soon to be installed in Mexico City, Mex. The plant will have an initial cost of $1,000,000 gold, an ouput of 3,000 tons of carbide yearly and consume more than 500 horsepower of electric energy from the Necaxa power plant.

### The Effect of Bark on Timber Preservatives.

As a result of some recent investigations by the United States Government it has been shown that before creosoting timber it is necessary thoroughly to peel off the thin inner bark of the wood if the preservative is to be absorbed by the timber to produce its maximum effect.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

## AN EXEMPLARY BOULEVARD ILLUMINATION.

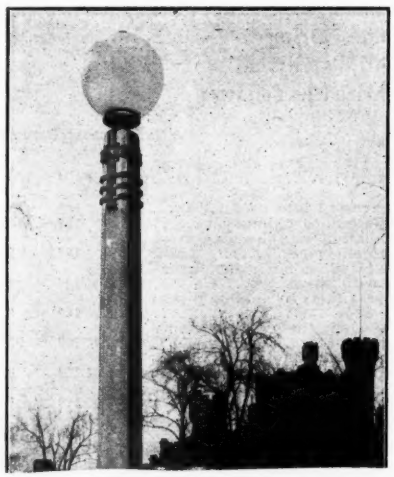
LIGHTING OF LINCOLN PARK BOULEVARD, CHICAGO.

There is no branch of public outdoor lighting for which the requirements are as exacting as the illumination of parks and boulevards. Owing to the absence of other fixed light sources, all the lamps that are installed become extremely conspicuous both by day and night. This means that the lighting installation must satisfy the art critic as well as the illuminating engineer, for whatever movement for a "city beautiful" there may be in the community it surely is expected to find its expression in the park system.

In the city of Chicago the park system is divided into three sections corresponding to the divisions of the city. The large parks are connected by a belt of boulevards, of which Lincoln Park Boulevard is an important part of the not yet quite completed link betw the north and south sides. On boulevard the traffic, which con chiefly of automobiles, is quite d and is bound to increase to many ti its present magnitude when the bc vard is carried over the Chicago R to join Michigan Boulevard in down-town district.

Lincoln Park Boulevard now ext from Ohio Street, on the south North Avenue, at its northern where it enters Lincoln Park, Chica most popular public park and the large park on the North Side. length of this boulevard is one one-half miles. The northern part was formerly known as the Lake Sl Drive since it follows the shore of L Michigan for about three-quarters mile. Along this portion of the bo vard are many of the finest reside and apartments in the city. At cago Avenue the boulevard passes tween the old Chicago waterworks the water tower, both well-known l marks of the city. South of this the boulevard continues for a half-mile along what was formerly known as Pine Street; this portion is somewhat narrower, but is lined on both sides with fine old homesteads.

The Lincoln Park Commissioners, to whom is entrusted the control of the North Side park and boulevard system,



itary District of Chicago. It was felt by the Commissioners that, in view of the importance of Lincoln Park Boulevard in the belt-boulevard system, the change in its lighting should be much more thorough than a mere substitution of lamps. Therefore, after a careful study of all aspects of the problem to determine which system of lighting would give the most uniform and brilliant illumination accompanied by freedom from glare and that would meet all the artistic requirements of the situation, it was decided to adopt the Daniels Boulevard Lighting System for the illumination of this great highway.

This system was devised by W. E. Daniels, formerly superintendent of the electrical department of the South Park System of Chicago. Its main feature consists in the use of a compact arc lamp entirely enclosed by a highly translucent and diffusing glass globe mounted on top of an ornamental standard. For this particular installation it was decided to make use of einforced concrete columns for the mp standards. This decision was ached because it was believed that this pe of standard would present a less nventional and yet more dignified pearance and result in lower maintnance charges.

The concrete columns were designed H. M. West, superintendent of the ncoln Park System, and they were nufactured by Lincoln Park emoyees directly under his supervision. good general view showing the dels of their design is shown in one of accompanying illustrations. The umn is of the obelisk type and is irteen feet high from the ground el to the base of the globe. To the ter of the arc the height is fourteen t and eight inches. A sub-base four t deep and fourteen inches square is de integral with the column. The umns are made in a horizontal mold the following manner:

At the base of the mold a crushed nite grout is first laid and plastered

part way up the sides. Inside this outer layer is placed ordinary Portland cement and crushed limestone concrete in which are placed a number of steel reinforcing rods. A two-inch iron pipe fifteen and one-half feet long is imbedded in the center. When the mold is practically full, a layer of the granite grout is placed on top and the upper side is then clamped on under pressure, thus squeezing out some of the material and completely filling all the edges of the mold. After setting about thirty-six hours, the top and sides of the mold are removed and the surfaces that are exposed are smoothed off. After about two more days' setting the column is rolled off the bottom of the mold and allowed to rest several more days. The surface of the column is finally washed with muriatic acid to remove the cement, thus leaving a finished surface of granitic pebbles. This surface, it is believed, will not only stand the weather very satisfactorily, but will improve in appearance with age, giving the columns the effect of being made entirely of granite.

The columns were hauled by derrick wagons from the place in the park where they were molded to their various locations along the boulevard. In setting the columns, after the hole is dug out and the concrete foundation laid to exact level as indicated by the surveyors, the column is mounted upon this foundation by means of a derrick. Concrete is then filled in around the sub-base until the entire base extends about three inches beyond the lower edge of the column at the ground level. The weight of each of these columns as molded is 2,000 pounds. They have been found to withstand very rough handling. In one instance an automobile run into one of them partly upsetting it with its foundation, before the latter had become completely set, without cracking the column at any point.

At the top of each column is placed a bronze grille cap which has a verde antique finish. This fits over the pipe which forms the core for the wires. Into the top of this pipe is screwed a bronze holder for the lamp. This has a similar finish and firmly locks the cap in place. The cost of the concrete columns as molded, not including the cost of erection, was $14.00 apiece. The bronze grille and holder at the top of each column cost $14.50.

The lamps used in this installation are seven-and-one-half-ampere series alternating-current inclosed arc lamps, manufactured by the Jandus Electric Company, of Cleveland, Ohio. They are supplied with constant sixty-cycle current and receive about seventy-two volts across the arc and eighty volts across the lamp terminals. The inner globe is seven and one-half inches long and fits about the arc so as to make the arc chamber practically air-tight, thus giving a long life to the carbons between trims. Surmounting the column is a twenty-inch glass globe which fits over the entire mechanism of the lamp, except for a small chimney of two inches diameter at the top which provides ventilation for the coils. This chimney, however, is very inconspicuous so that the lamp appears to be entirely inclosed by an unbroken globe.

Both the inner and outer globes are made of Alba glass, manufactured by the Macbeth-Evans Glass Company, of Pittsburg, Pa. This glass is very strong and diffuses the light excellently without cutting it down appreciably. The lamps are suspended in a trunion mounting so that they can be swung out at the lower end. In trimming the lamps, which is done by means of a tower wagon, the outer globe is removed, the lower portion of the lamp swung sideways, the inner globe then removed and the carbons replaced.

In the present installation there have been placed on Lincoln Park Boulevard 140 lamps of this type. They are placed directly opposite each other, an equal number on each side of the roadway. The average spacing is 100 feet between lamps. The roadway north of Chicago Avenue is forty-five feet wide, and that south of this point is only thirty feet. The general effect of the illumination is shown very well by the two accompanying night views. The streaks near the ground in these pictures were caused by headlights of automobiles. A marked feature of this lighting which has been noted both by pedestrians and automobilists is the uniformity of the light distribution and the absence of glare. There is no doubt that from all points of view it is one of the best lighting installations for a boulevard that has ever been installed.

The Lincoln Park Commissioners have also made use of the same type of column and lamp for the lighting of the beach drive along the eastern border of Lincoln Park. In this case the lamps are placed in one row on one side of the driveway. There are thirty-

Looking South from Chicago Avenue.

Looking South from North Avenue.

NIGHT VIEWS ALONG LINCOLN PARK BOULEVARD, CHICAGO.

one lamps in this installation. There are also four lamps of this general type on the boat-landing of the south refectory, but the lamps in this instance are multiple lamps. It is the intention of the Commissioners eventually to replace all of the lamp standards in Lincoln Park by concrete columns of the type described. There have been erected in Stanton Park, one of the smaller parks of the system, thirty concrete columns surmounted by five sixty-watt tungsten lamps in a twenty-inch Alba glass outer globe.

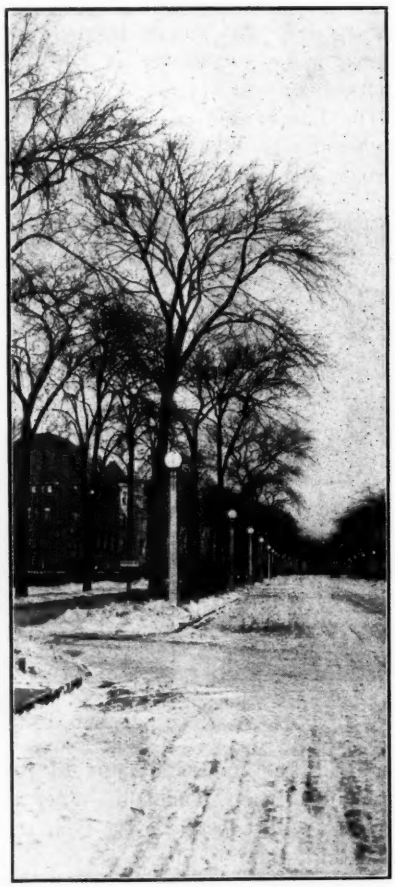
Most of the data on which this article is based were kindly furnished by E. C. Rutz, superintendent of the electrical department of the Lincoln Park system, and by C. W. Beach, of the Chicago office of the Jandus Electric Company.

### Electricity versus Gas for Train Lighting.

In the issue of December 3 the *Electrical Review*, of London, England, takes the above topic as the subject for an excellent editorial article, from which the following is taken:

Of all the uses to which electricity is particularly well adapted, there are few that are more conveniently and appropriately served by that agent than the lighting of railway trains. As was pointed out some years ago, in connection with one of those periodical disasters which cannot be averted even by the utmost exercise of engineering skill and foresight, one of the most valuable attributes of electric lighting for trains is its complete immunity from fire risk. In the instance to which reference is made, the horrors of the collision were intensified manifold by a conflagration resulting from the use of gas for lighting the train, which rendered the rescue of some of the victims impossible. It is bad enough to be battered and maimed, without the added torture of roasting to death before the eyes of one's helpless relatives and friends.

There is another factor, however, which acts much more quickly, and much more effectively, than such considerations as the interests of passengers, the influence of the Board of Trade, or the pressure of public opinion: and that is, the interests of the railway companies themselves. One way of bringing this home to them was recently exemplified in striking fashion on a French railway, where gas was employed as the illuminant. As the result of a derailment, a number of mail cars were set on fire by escaping gas; twelve postal employes were seriously burnt, the mails were completely destroyed, and the cars reduced to ashes. The value of the registered letters and postoffice orders destroyed amounted to more than $120,000, apart from the cost of the cars. On another occasion, two new cars caught fire through an escape of gas whilst leaving the depot and were destroyed; each of them cost $14,000. Thus in a short period the railway company lost $148,000, a loss wholly and solely due



ANOTHER VIEW ALONG LINCOLN PARK BOULEVARD, CHICAGO.

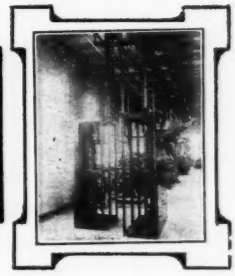
to its choice of gas instead of electricity for lighting. The company is liable to suffer similar losses at any time, and it is difficult to realize how any railway manager in his senses can accept this risk for the sake of a slight supposed advantage in running cost, which may or may not be justified by the facts.

Leaving on one side the unquestionable advantages of electricity on the score of safety from fire risk, is it the fact that it is inferior to gas in point of cost? We have made it our business to inquire into this question, and have obtained authoritative data as to the actual cost of lighting with compressed coal-gas and inverted mantles, as used upon a certain French railway. Taking the cost of gas at $1.08 per 1,000 cubic feet, and assuming that the mantle maintains its full candlepower throughout its life, the cost per candlepower-hour is about 0.02 cent. In English towns the cost of gas will be in the neighborhood of one-half of the price just given above, and this correction would reduce the total cost per candle-hour by one-third; but against this can be set at least an equal falling-off in the average candlepower of the mantle, which leaves the cost per candle-hour, under British conditions, at 0.02 cent. The weight of the storage tanks and pipes amounts to considerably over a ton for an installation of twelve lamps of twenty-five candlepower each, and they add some four square feet to the transverse section of the coach offering resistance to the air.

On the other hand, using metallic-filament lamps, which have a life of about ten times that of the gas mantles, and maintain their candlepower practically unaltered throughout their lives, and allowing outside figures for the depreciation of plant, interest on capital, maintenance, and cost of additional fuel used on the locomotive, the total cost per candlepower of an electric lighting system on modern lines does not exceed 0.022 cent. Charging stations are done away with; any coach can go anywhere, at any time, and no loss of time is incurred in charging. The weight of the equipment for the same duty is less, and the air-resistance is reduced. The lamps, instead of having a minimum candlepower of twenty-five candlepower, can be of ten candlepower, or less, and can be distributed or arranged so as to give the best results, or put in series to give a dim light when passengers wish to sleep. By adopting recent improvements, the cost of the system can be materially reduced below the figure quoted—which, in fact, is in excess of actual results obtained on British trains.

Therefore, not only for its safety, but also for its economy and convenience, the electric system is far in advance of even the most up-to-date system of gas lighting, and any railway company that adopts the latter is committing a grave error, which will be remedied only at great cost to the shareholders. In America the tendency today is to abandon gas in favor of electricity.

# Industrial Power



## THE RESICZA IRON AND STEEL WORKS.

AN INTERESTING DESCRIPTION OF AN ELECTRICALLY DRIVEN HUNGARIAN FACTORY.

In the mountains of Southeastern Hungary, in the V indicated by the Servian and Roumanian frontier lines, is Resicza. It is a small place, so far as cities go, but it represents in its population one of the most interesting iron and steel works in Europe. What Krupp is to Germany and Le Creusôt to France, so Resicza is to Hungary. A grade of steel is being turned out in these Hungarian works the equal, it is claimed, of the best in the world. The force actually employed at Resicza numbers about 6,000 men. The total force employed in all the shops and works of the company, having in mind only Hungarian territory, is 18,000. The name of the concern controlling the Resicza works is The Privileged Austro-Hungarian State Railway Company.

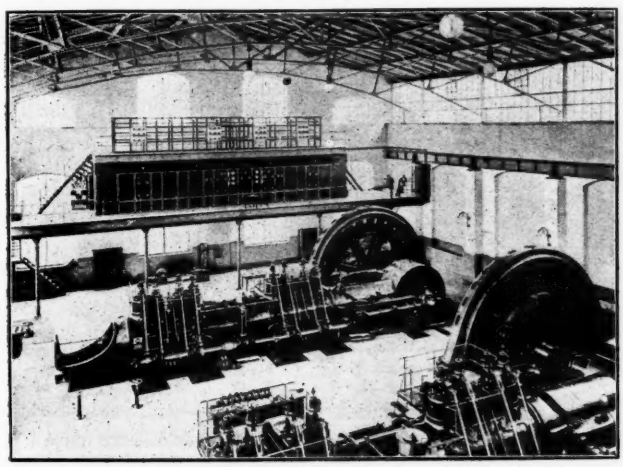
Resicza is essentially a steel-making plant, although the manufacturing end of the business is an important one. At the present time the annual production of steel is about 100,000 tons, the largest part of which is produced by the Martin-Siemens open-hearth process. The Bessemer plant produces 20,000 to 25,000 tons of Bessemer steel annually by means of three converters, each of ten tons capacity. Fluid pig iron is cast in these converters direct from the smelting works, and the steel produced is largely used for rails.

The annual output capacity of raw iron at Resicza is about 65,000 tons, but this production, it is stated, will shortly be increased to 110,000 tons. The iron ore at Resicza is worked up at present in three blast furnaces, one having a capacity of 120 tons per day and two having a capacity of seventy tons each per day. A new blast furnace, now in process of building, is designed for a capacity of 250 to 300 tons per day. This new furnace is the design of Julien Kennedy, of Pittsburg, Pa. Arrangements for the building of this Kennedy furnace were effected, it is said, through Kennedy's European representative located in Brussels. There are five open-hearth furnaces in the steel works.

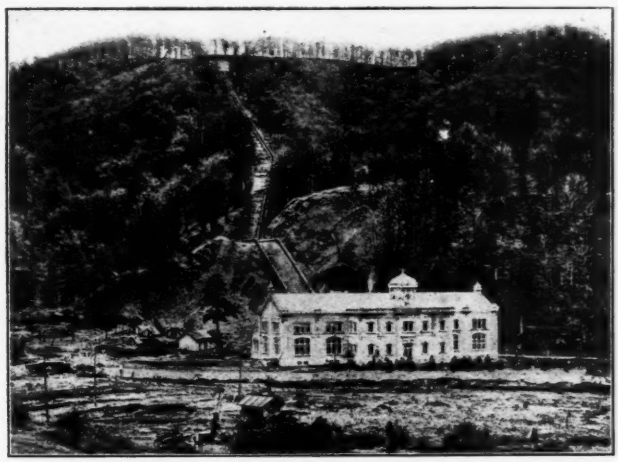
It is the practice at Resicza to fill thirty-five small ingot molds at one pour, the entire thirty-five molds being carried in a frame, the design of Georg Marton. One of the furnaces handles thirty-six molds.

Resicza has been utilizing blast-furnace gas for the past thirty-five years, and today a large proportion of the power availed of is furnished by gas engines. Both blast furnace and gas producer are used. The gas-producer system employed is of the Kerpely design. In all there are fourteen gas producers in service for the steel-making plant. In one central station there are four gas engines, each of 1,650 nominal horsepower, running at ninety-seven revolutions per minute. The engines were built by Léng, of Budapest, after the Erhardt system; the generators, by the Union A. E. G., Vienna. These electrical generators are generating alternating three-phase current of 20.8 periods, 5,500 volts, 1,100 kilowatts. All four engines are running in parallel, and parallel with a second hydroelectric central station of 6,000 kilowatt-amperes capacity. These gas engines are giving little trouble and are very economical.

Resicza employs the Veith system for washing gas, supplemented by an additional washing through the medium of the Theisen system. From the Theisen washers the gas goes direct to the gas engines without recourse to gas reservoir. In case the blast-furnace gas gives out at any time the gas engines can be run on producer gas, but ordinarily the producer gas is utilized only



GAS-DRIVEN GENERATORS AT RESICZA.



HYDROELECTRIC PLANT AT RESICZA.

The above description is an abstract of a report by Special Agent Capt. Godfrey L. Carden (*Consular Report* No. 3649). The photographs from which the illustrations were made, were kindly loaned by the Bureau of Manufactures, Washington, D. C.

for the furnaces. The producer gas, when used for power-generating purposes, must naturally first be washed.

There are eight Belleville boilers in service and, in addition, there are ten boilers in use similar in type to the Babcock & Wilcox. These latter boilers were made in Resicza With the exception of three Worthington pumps, all the pumps in service have been built at Resicza. The air compressors, furnishing the air for the blast furnaces, are supplied with motors from Siemens & Halske. There are four of these motors attached to as many compressors, of 280 horsepower each. There are also two horizontal compound steam-driven blowing engines of 650 horsepower each. A turbo-compressor, with a capacity of 1,000 cubic metres (35,316 cubic feet) per minute, and directly driven with a 2,000 horsepower electrical motor, will furnish the necessary air to the new blast furnace.

In the Resicza rolling-mill plant the heavy mills, such as blooming mill, the structural-iron mill, and the heavy-plate mill, are driven by two sets of electric motors, each capable of yielding a maximum of 10,000 horsepower. There is also a steam engine of 4,000 horsepower which is held in reserve. The electrical engines permit of reversing from maximum to maximum in eight seconds. The maximum number of revolutions is 150 per minute. These engines are used in connection with the manufacture of rails, plates and blooms. The diameter of the largest roll in the blooming mill is one metre (3.28 feet), and the ratio of gears is one to two. The mills are all reversible from both sides of couplings. The motors yield 2,000 horsepower effective, and give 10,000 horsepower through the help of a flywheel, after the system Ilgner. The circumferential speed of the flywheel is ninety metres (295 feet) per second. The speed of the motor generator, which gives energy for the reserving motors, is 410 revolutions per minute.

In addition to the central power station, operated by gas engines, Resicza is using 4,000 horsepower from a hydro-electric station, distant not more than three miles from the center of the works. The waterfall at this station is 217 metres (712 feet) in length. Three turbines are installed, each yielding 2,500 horsepower, working in connection with Pelton wheels, and equipped with automatic regulators. The generators yield 5,500 volts three-phase current of 20.8 periods per second, running at 312.5 revolutions per minute. The generators were built by the Siemens-Schuckert Works of Nürnberg.

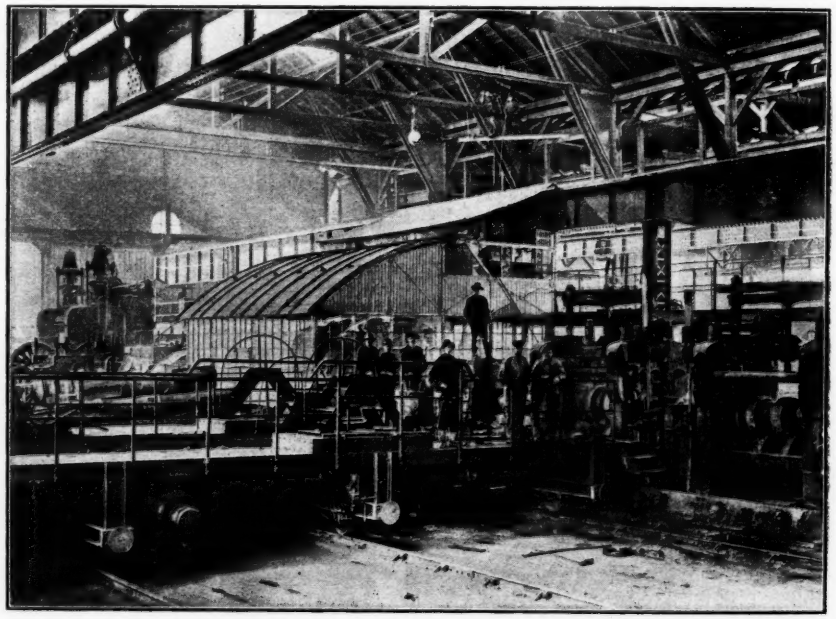
In addition to the foregoing rolling mill, mention should be made of the sheet-plate mill, which is being operated with Ganz motors of 900 horsepower, 500 volts three-phase current. These motors are coupled direct to roller shafts and afford a speed of fifty revolutions per minute.

There is also at Resicza a three-high rail mill, equipped with three sets of rolls, steam-driven. This mill is German built, but is said to be in reality of English design. The reversing mills were also built by Germans; that is to say, the mechanical part of the mill is German in all respects, except the electrical equipment. There is at present at Resicza an old rolling mill which is referred to as the merchant mill, the equipment of which is to be entirely torn out and replaced with new mills, operated by steam and electric drive. There is required for the new equipment 4,000 horsepower. It is said that Resicza is desirous of receiving this millwork from American sources. With this object in view, inquiries were recently made of one American firm.

The tire mill at Resicza produces tires from 500 to 2,500 millimetres interior diameter, and is turning out probably as fine work as can be found anywhere in Europe. In the United States, Bethlehem, Midvale, Chrome and Latrobe may be said to be doing work similar to Resicza, but in Hungary, Resicza is the only source for steel tires. There is no denying that the tire work at Resicza is most skillfully handled. The equipment for the tire shop is practically all English. On entering the tire mill one can hear what appears to be an unmistakable sound of many wonderfully toned bells. The sound comes from workmen knocking off heat scales from numerous locomotive tires, but the ring from the hammers gives unmistakable evidence of the splendid quality of the steel. Resicza supplies practically all tires used in high-speed equipment on the Hungarian railways.

In the car-wheel molding department, German molding machines are used. The loading cranes for loading rails were supplied by Simmering, of Vienna. Two heavy cold saws in the rail department were furnished by Heinrich Ehrhardt, of Düsseldorf. Wagner and Company, of Dortmund, have supplied a heavy punching machine for splice bars, one double punch of 400 tons pressure, and five rail milling machines. Sack, of Rath, has supplied one very heavy double punch of 500 tons pressure. The frame for this punch was made at Resicza. Shultz & L. Gobel, of Vienna, have supplied a punch machine, and it is said that this last mentioned Austrian tool is liked better than the Wagner or Sack punches.

The manufacturing works at Resicza are concerned largely with equipment for railway bridges and iron construction, ship and engine parts, and at the



THE ROLLING-MILL PLANT AT RESICZA.

present writing there are extensive orders in hand for field-artillery equipment. Resicza has been called upon during the past five years to supply stem and stern frames and other pieces for the Armstrong Works of England, and for Ansaldo, of Genoa, Italy, for use in warship construction. In the machinery department the number of machine tools approximates 350. These machines are almost without exception driven by electric power derived from overhead shafting. This electric drive is by three-phase induction motors of 20.8 cycles, 500 volts.

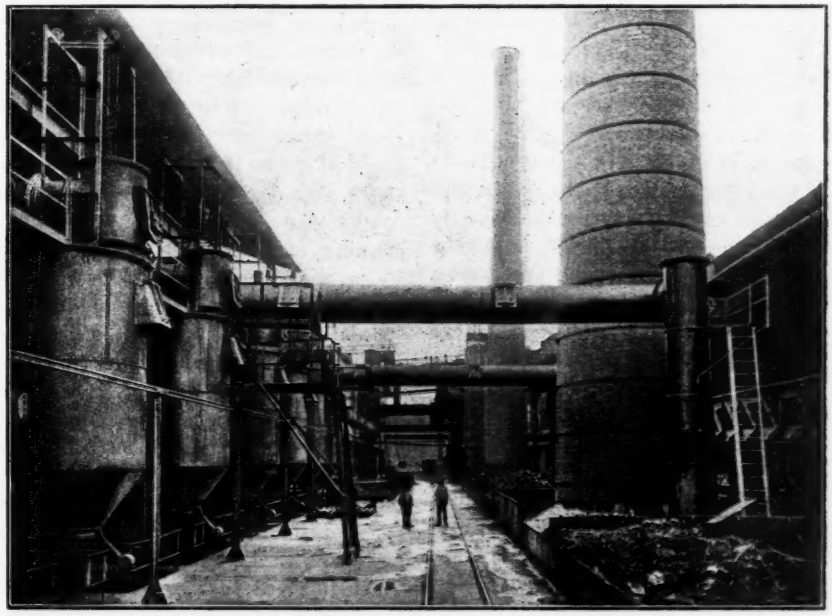
There are some excellent tools of American make in evidence, but the number is very small. There are, however, three Gisholt turret lathes. These machines are working up and finishing off projectiles. It is stated that a Gisholt representative visited Resicza and spent some time in the works giving instructions relative to these machines, and, so far as is known, Gisholt's engineer is the only American machine-tool man whom the Resicza officials can recall having visited that establishment. The Gisholt machines are liked in principle, but it is said that the size of the machines in use is regarded as somewhat light for the heavy duty imposed.

There are four grinders from the Landis Tool Company, of Waynesboro, Pa. These Landis machines are highly appreciated. Two of the vertical drills in use were made by Prentice Brothers Company, Worcester, Mass., and one No. 2 and one No. 3 milling machines from the Cincinnati Milling Machine Company, Cincinnati, Ohio. Pratt & Whitney, of Hartford, Conn., are represented by a thread-milling machine, and Gould & Eberhardt, of Newark, N. J., are in evidence with a gear cutter. These appear to comprise all the American machine tools in service at Resicza.

In the forge department there are plate-cutting shears from Sack, of Rath, Germany. Resicza has made all rolls for its rolling-mill installation. In the forge department there is one hydraulic press of 600 tons power, furnished by Breurer, Schmumacher and Company, of Kalk, near Cologne. The same German firm has supplied the horizontal hydraulic press employed in forming the larger sized projectiles.

At the present time Resicza has in hand an order for projectiles of twenty-one, twenty-four and thirty-two centimetres. These shells are built of open-hearth steel, Martin process. The furnaces in the forge department are blast operated. Resicza is making both cast-drawn and forged-steel projectiles. All projectiles which are hardened are also drawn as a preliminary to the operation.

The main machinery building is employing at present about 1,400 men. The greatest number of machine tools from any one firm in this building is probably from Vulkan. Vulkan has furnished a great variety of machines, but the Vulkan lathe is the one type of tool most in evidence. There are a number of vertical millers of Vulkan manufacture, closely resembling the Becker design. There are some German vertical millers in evidence which also seemed to be built on Becker lines.



THE GAS-PRODUCER PLANT AT RESICZA.

Alfred Herbert (Limited), of Coventry, England, has placed some sensitive drills, and Zimmerman, of Chemnitz, has provided a number of heavy lathes. One heavy tool of the lathe type was noticeable, apparently English in build, but without the name of the maker showing. Whitworth, of Manchester, England, has supplied a heavy lathe, and Ernst Schiess has installed a large-sized planer. Vulkan has supplied some cold-steel saws, as has also De Longdoz and also Deneffe, both of Belgium.

Among other foreign tools in use were slotters from Loewe and Vulkan; heavy vertical millers from Kendall & Gent, Manchester, England; shapers, vertical millers, boring mills, planers and gear cutters from Vulkan; traveling cranes from Ganz; vertical miller from Fairbairn, of Leeds; a heavy vertial miller from De Fries; thread cutters from Zimmerman, milling machine from Buckton, of Leeds, and a radial drill from Whitworth. Both the Deutsch-Niles Werk and the Globe Pneumatic Engineering Company (Limited), the latter of London, have supplied pneumatic tools.

The annual output of iron ore from all the mines of the Privileged Austro-Hungarian State Railway Company is about 200,000 tons.

### An Improved Single-Phase Motor.[1]

A remarkable improvement in single-phase motors has been devised by Mr. Deri, and practically developed by Messrs. Brown-Boveri. Mr. Deri's motor may best be explained by reference to the original so-called repulsion motor, invented very early in the history of alternating current engineering by Elihu Thomson. In this motor the rotor is of the same type as the armature of a continuous current motor, but the brushes are short-circuited on each other, and are mechanically so arranged that the brush axis may be set at various angles to the axis of the stator field.

If set at ninety degrees (electrical), no current passes through the rotor, and if set co-axially, the rotor takes a maximum current, being, in fact, the short-circuited secondary of a transformer. In both these extreme positions no torque

1 Abstracted from Dr. Gisbert Kapp's presidential address to the Institution of Electric Engineers, London, England, November 11, 1909.

is exerted, but in an intermediate position a torque is exerted, and if the rotor is allowed to run, the current is reduced and the power factor increased.

Mr. Deri employs two sets of brushes, one being fixed in the polar axis of the stator, and the other so adjustable as to include different angles with the fixed brushes. In a two-pole motor there are thus four brushes required. The movable brushes are not shorted on each other, but each is shorted on its corresponding fixed brush. If the fixed and movable brush are in line and bearing on the same part of the commutator, no current passes through the armature. If their angular distance is 180 degrees, the armature winding acts as the shorted secondary of a transformer. In neither case is a torque exerted. If, however, the angular distance between fixed and movable brush is intermediate between no degrees and 180 degrees, a torque is exerted, and if the armature is allowed to run the current decreases and the power factor increases.

The effect of shifting the brushes is analogous to changing the impressed voltage on an ordinary continuous-current series motor, and thus by adjusting the brushes the torque and speed may be regulated. This property renders the Deri motor valuable in all cases where delicate speed regulation is essential. It is largely used for working passenger lifts and other hoisting machinery, and also for driving ring-spinning frames, the speed regulation in the latter case being automatic. The result of automatic speed regulation is an increased output from the ring-spinning frames. Another application is for electric-railway working. An important point in these motors is their perfect commutation.

## Applications of Electricity to Propulsion of Naval Vessels.[1]

Two distinct methods of electrical propulsion of ships, both adapted to battleships of the design of the *Arkansas* and *Wyoming*, are described. These are designated by the author as follows: (1) "Combination drive," in which generating units with motors, and low-pressure turbines on propeller shafts are used together and separately for different conditions; (2) "electric drive," in which propulsion is effected wholly and solely by electric motors.

*Combination Drive.*—With the "combination drive" it is proposed to use twin screws and to install upon each propeller shaft a low-pressure turbine and an electric motor. There would also be installed in each engine room a high-speed, steam-turbine, generating set. The capacity of the generators and motors would be such that they would be capable of delivering, at 20.5 knots, two-fifths of the total power required for propulsion. The remaining three-fifths of the power under these conditions would be delivered by the low-pressure turbine which at such a time would receive steam exhausted from the generating unit. This low-pressure turbine would also be fitted with two reversing stages, similar to those which would be adopted with direct turbine drive. The low-pressure turbines would also be so arranged that they could take high-pressure steam from boilers through separate nozzles and with such supply they would act as fairly efficient high-pressure turbines. With such high-pressure steam supply the ship would make a speed of about 19.0 knots with the same steam requider for 20.5 knots with the combination drive. When the ship is running at about 20.5 knots all the steam would pass to the low-pressure turbine. When the ship operates at speeds below fifteen knots the low-pressure turbine would not be used at all, the power being delivered to the propellers entirely by motor and being all generated by the high-speed turbine. At speeds between fifteen and 20.5 knots, a part of the steam would pass to the condenser through the low-pressure turbine and part through the lower stages of the high-speed turbine. The design of the generating unit provides for a valve by which any desired number of third stage nozzles can be closed and by this means the division of steam between the low-pressure stages of the high-speed turbine and the low-pressure turbine can be controlled.

In this combination drive, the electrical apparatus acts simply as a speed-reducing bond between the generating turbines and the propeller shafts. The motors are not used for reversing and are of the squirrel-cage induction type. The voltage is low and the arrangement of generator and motor constitutes the simplest known means of electrical power transmission.

Since in a warship it is desirable to operate efficiently at low speed as well as at high, the motors proposed in this case are so arranged that they can be connected either for twenty-eight or forty-two poles. In the higher-speed ranges the twenty-eight pole connection is used, and in the lower-speed ranges the forty-two pole connection.

In this arrangement, the electrical apparatus with high-speed turbine constitutes an auxiliary, the purpose of which is to improve efficiency under all speed conditions and particularly to adapt the ship to economical operation at cruising speed.

This combination drive is proposed by the author as a sort of a stepping stone between the purely mechanical drives at present in use, and a purely electrical drive,—this with a view to overcoming the doubts and fears of those who might object to too rational a change in existing practice. This design also allows for substitution of high-pressure turbines for the motors to change over to a high-pressure Curtis drive, if desirable.

*Electric Drive.* — With "electric drive" it is proposed to install two motors on each propeller shaft. One of these is arranged with pole-changing switches for varying the speed. The other is adapted only to the smaller number of poles used with high speeds, and is arranged with a resistance connection so as to be suitable for producing the high torque desirable in quick changes of the ship's directions. The generators are designed to give a very uniform efficiency through wide ranges of load and speed. The maximum voltage generated is about 2,200 volts.

The armature resistances for the motors used in reversal of the propellers, would be connected to the motor through collector rings, and the resistance would be cut out by short-circuiting the collector rings so that no current would pass through the brushes except when the resistance was in use.

A comparison of the weights of the all-turbine, combination, and electric drives, is given by the author as follows: Turbine (Parsons) drive, 484.7 tons (excluding piping, bearings, shafting, valves, and auxiliaries); combination drive, 520 tons; electric, 354 tons.

The weight of boilers proposed for the ships under consideration, is 555 tons, and the author estimates that with electric drive this can be cut down by 108 tons if allowance is made for the saving in steam consumption at 20.5 knots as indicated by his figures. The author further estimates that with electric drive an increase of sixty-nine per cent in the cruising distance may be obtained.

1 Abstract of a paper by W. L. R. Emmet, presented at the seventeenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 18 and 19, 1909.

## FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

### NEW YORK TRACTIONS.

The New York Public Service Commission for the First District has issued the following statistics in connection with passengers carried and revenues derived from operation in traction lines of New York during the month of September, 1909:

| | Fare passengers Aug., 1909 | Fare passengers Aug., 1908 | *Tot. rev. per st. ry. oper. Aug., 1909 |
|---|---|---|---|
| Hudson & Manhattan | $3,082,924 | $933,509 | $159,436 |
| Inter. Rap.-Tran. | 44,381,238 | 38,128,312 | 2,286,234 |
| Brooklyn Rapid Transit System: | | | |
| Brooklyn Union "L" | 12,365,251 | 11,338,903 | 646,262 |
| Sea Beach | 261,777 | 73,361 | 13,881 |
| So. Brooklyn | 836,076 | 694,859 | 46,142 |
| Total "L" service | $13,463,104 | 12,107,123 | $706,285 |
| Brooklyn Hgts. | 12,306,543 | 11,319,570 | 621,027 |
| Brooklyn G. Co. Sub. | 2,150,170 | 2,163,151 | 111,827 |
| Coney Island & Groves | 124,808 | 117,391 | 6,552 |
| Nassau Electric | 7,265,245 | 6,466,422 | 373,488 |
| Total B. R. T. system | 35,309,872 | 32,173,657 | $1,819,180 |
| ‡Third Avenue System: | | | |
| Dry Dock and E. Broadway | $926,025 | $970,893 | $50,588 |
| 42d St. M. & St. N. | 2,680,588 | 2,092,402 | 136,647 |
| Third Ave. & Kingsbr. | 4,412,731 | 3,873,196 | 260,813 |
| South Boulevard | 177,128 | 138,297 | 8,856 |
| Union Railway | 3,513,393 | 2,921,926 | 179,223 |
| Westchstr. Elec. | 893,764 | 658,386 | 44,816 |
| Total | $12,603,629 | $10,655,100 | $680,945 |
| Manhattan & Bronx surface roads: | | | |
| Metro. St. Ry. | $23,703,796 | $22,681,395 | $1,203,088 |
| Central Park, N. & E. | 1,008,903 | 920,479 | 53,500 |
| Second Avenue | 1,467,610 | §..... | 76,274 |
| 28th & 29th St. | 34,460 | §..... | 1,749 |
| Total Man. | $26,214,769 | $23,601,874 | $1,334,611 |
| City Island | 17,474 | †..... | 828 |
| Pelham Park | 23,291 | †..... | 1,170 |
| New York City Interboro | 355,367 | 246,965 | 16,556 |
| Total Man. & Bronx | $26,610,901 | $246,965 | $1,353,165 |
| Brooklyn & Queens surface roads: | | | |
| Coney Island & Brooklyn | $2,800,876 | $2,152,609 | $137,157 |
| Long Isl. Elec. | 318,504 | 301,926 | 17,825 |
| N. Y. & L. I. Traction | 711,231 | 634,127 | 35,549 |
| N. Y. & Queens Co. | 1,757,125 | 1,637,037 | 91,910 |
| Ocean Electric | 200,165 | 221,536 | 10,563 |
| Van Brunt St. & E. Broadway | 143,953 | 140,599 | 4,135 |
| Total Excluding B. R. T. | $5,931,854 | $5,087,834 | $297,139 |
| Richmond Electric roads: | | | |
| Richmond St. & R. R. | $611,281 | $550,973 | $31,373 |
| South Beach | 15,985 | 13,688 | 799 |
| Staten Isl. Midl'd | 540,872 | 491,718 | 27,367 |
| Total | $1,168,138 | $1,056,359 | $59,539 |
| Grand total all costs | $129,088,556 | $112,483,610 | $6,655,639 |

*Totals in this column exceed revenue of all companies regarded as a single system by reason of inter-company payments for power, rent of tracks, etc.
†Not reported.
§Operated by Metropolitan Street Railway in September, 1908.
‡Exclusive of the Tarrytown, White Plains & Mamaroneck and the Yonkers Railroad.

### NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY.

In accordance with the new law placing telephone companies in Massachusetts under supervision of the Highway Commission, the annual report of the twelve months to June 30 last of the New England Telephone and Telegraph Company has been filed. The income account as of June 30, 1909, and 1908 compares as follows:

Gross, $11,031,289, inc. $577,305; operating expenses, $8,306,472, inc. $240,804; net, $2,724,816, inc. $336,500; other income, $260,004, inc. $29,159; total net, $2,984,821, inc. $365,660; charges, $161,035, dec. $200,272; balance, $2,823,786, inc. $565,932; dividend, $2,194,639, inc. $292,771; surplus, $629,147, inc. $273,161.

On June 30 last there were 3,832 stockholders in the company, of whom 3,401, or eighty-nine per cent, are residents of Massachusetts, owning 136,519 of the 356,244 outstanding shares. The American Telephone and Telegraph Company, the parent company, owns 208,058 shares.

This compares with 3,700 stockholders on June 30, 1908, of whom 3,275, or eighty-eight per cent, were residents of Massachusetts, owning 135,651 of the 355,095 shares.

### SCHENECTADY RAILWAY.

The report of the Schenectady Railway Company, for the quarter ended September 30, 1909, compares as follows:

| | 1909. | 1908. |
|---|---|---|
| Total operating revenue | $296,163 | $264,272 |
| Total operating expenses | 160,017 | 169,114 |
| Net operating revenue | $136,146 | $95,158 |
| Taxes accrued | 12,788 | 8,891 |
| Operating income | $123,357 | $86,266 |
| Other income | 3,399 | 4,184 |
| Gross income | $126,757 | $90,450 |
| Total deductions from gross income | 23,809 | 26,780 |
| Net corporate income | $102,947 | $63,670 |

### UNITED TRACTION, OF ALBANY.

The report of the United Traction Company (Albany) for the quarter ended September 30, 1909, compares as follows:

| | 1909. | 1908. |
|---|---|---|
| Total operating revenue | $554,360 | $520,679 |
| Total operating expenses | 312,803 | 302,187 |
| Total net revenue from operation | $241,557 | $218,492 |
| Taxes accrued | 33,000 | 28,736 |
| Operating income | $208,557 | $189,755 |
| Other income | 50,034 | 40,014 |
| Gross income | $258,591 | $229,769 |
| Total deducted from gross income | 94,732 | 70,140 |
| Net corporate income | $163,858 | $159,629 |

### WASHINGTON WATER POWER.

The Washington Water Power Company has rendered a report to the New York Stock Exchange for the year ended October 31, 1909, as follows:

| | |
|---|---|
| Receipts | $2,735,738 |
| Expenses and taxes | 1,459,666 |
| Net receipts | $1,276,072 |
| Allowance for depreciation | 268,600 |
| Balance | $1,007,472 |
| Interest | 356,090 |
| Available for dividends | $651,382 |

### BOSTON & WORCESTER.

The Boston & Worcester Street Railway Company has issued its report for the year ended September 30, 1909. The general balance sheet as of October 1, 1909, compares as follows:

ASSETS.

| | 1909. | 1908. |
|---|---|---|
| Property investment | $4,776,528 | $4,646,118 |
| Cash | 92,026 | 115,113 |
| First mortgage discount | ..... | 59,000 |
| Accounts receivable | 14,436 | 34,841 |
| Cash to secure bonds | ..... | ..... |
| Supplies on hand | 89,416 | 82,242 |
| Prepaid interest and insurance, etc. | 9,074 | 10,460 |
| Total | $4,981,480 | $4,947,774 |

LIABILITIES.

| | | |
|---|---|---|
| Capital stock | $2,025,000 | $2,025,000 |
| Fnuded debt | 1,970,000 | 2,016,000 |
| Notes payable, held by Boston & Worcester Electric. | 600,000 | 535,000 |
| Notes payable | 267,482 | 267,365 |
| Accounts payable | 51,082 | 43,561 |
| Interest accrued | 24,860 | 19,655 |
| Taxes accrued | 40,183 | 39,775 |
| Profit and loss surplus | 2,873 | 1,418 |
| Total | $4,981,480 | $4,947,774 |

The income account of the Boston & Worcester Electric Companies, the holding company, for the year ended September 30, 1909, compares as follows:

| | 1909. | 1908. |
|---|---|---|
| Dividends received | $60,748 | $121,494 |
| Other income | 35,757 | 20,167 |
| Total income | $96,505 | $141,661 |
| Interest, etc. | 20,090 | 5,303 |
| Surplus | $76,415 | $136,358 |
| Dividends | 67,872 | 135,744 |
| Surplus | $8,542 | $614 |

### NORTHERN CALIFORNIA POWER.

The Northern California Power Company, Consolidated (succeeded Northern California Power Company November 1, 1908) has issued its first annual report for the year ended October 31, 1909. The income account compares with the earnings of the company before its reorganization for the years ended February 29, 1908 and 1907, as follows:

| | Oct. 31 1909 | Feb. 29 1908 | Feb. 28 1907 |
|---|---|---|---|
| Gross earnings | $432,715 | $297,062 | $214,830 |
| Profits on store account | 1,114 | 3,516 | 10,113 |
| Total earnings | $433,829 | $300.578 | $224,943 |
| Expenses and fixed charges | 259,202 | 165,099 | 128,690 |
| Surplus | $ 74,627 | $135,479 | $96,244 |
| Dividends | 110,000 | 40,000 | 60,000 |
| Net surplus | $ 64,627 | $ 95,479 | $ 36,244 |

For the eight months, March 1, 1908, to October 31, 1908, gross earnings amounted to $245,375 and surplus after charges 5139,840.

### TARRYTOWN, WHITE PLAINS & MAMARONECK.

The Tarrytown, White Plains & Mamaroneck Railroad Company reports gross earnings for the quarter ended September 30, 1909, of $49,988, against $45,977 last year; net income amounted to $3,706, against a deficit last year of $1,254, and there was a deficit after charges of $1,979, against a deficit of $5,198 last year.

# INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

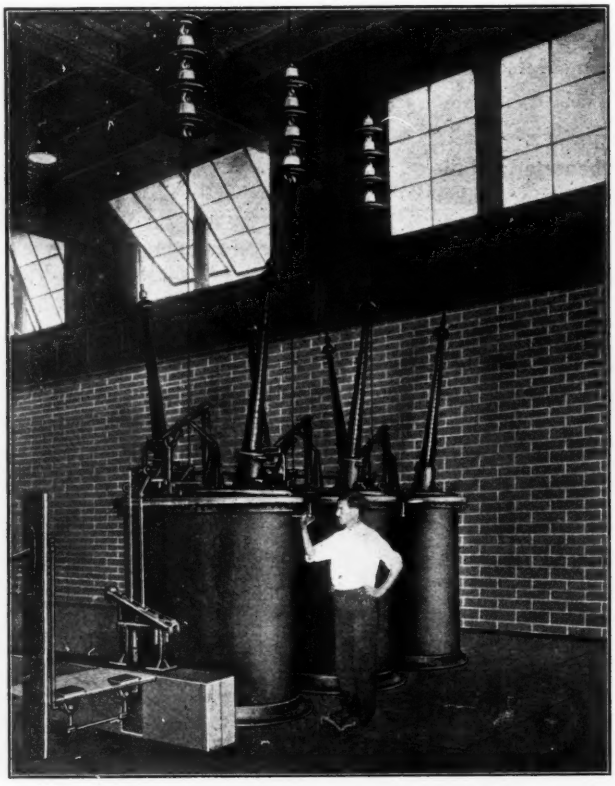
**The 110,000-Volt Circuit Breakers on Lines of Southern Power Company.**

Four groups of 110,000-volt oil circuit-breakers were recently put in service by the Southern Power Company on its high-tension transmission lines in the vicinity of Charlotte, N. C. This installation is unique as being the first in which switching apparatus is called upon to break currents of this extreme potential, although several similar plants are now under construction and will shortly be in operation.

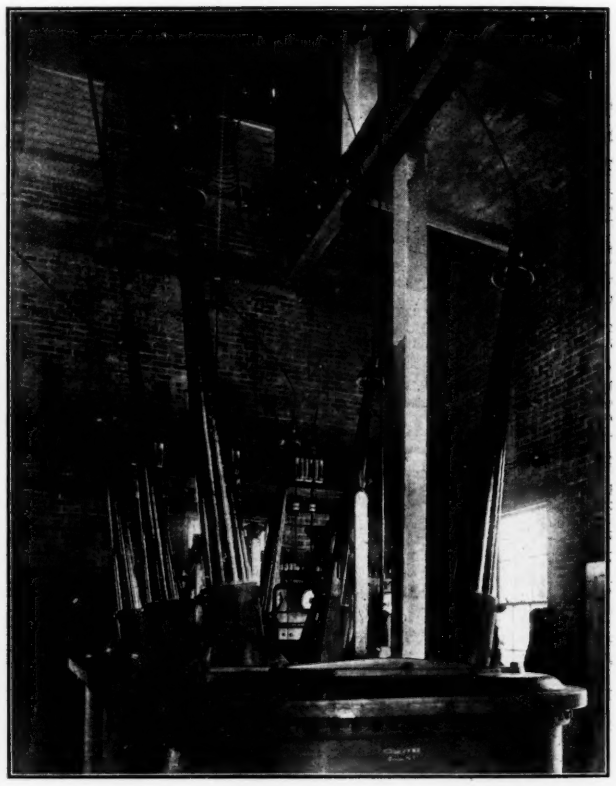
As shown in the accompanying illustration, a feature of the construction of these circuit-breakers is the isolation of each pole in a separate tank. Each pole is thus entirely independent of the others except for the pull-rod which operates the contacts. This rod is released by the tripping mechanism shown at the left of the tanks, allowing the contacts to open by gravity. The forty-seven-inch break thus interposed into each phase occurs in the center of the tank, in oil free from any possible sediment or moisture. By the arrangement of the operating mechanism, gravity assists in making a quick break during normal operation, while in case of any injury to the circuit-breaker parts the circuits naturally tend to fall open.

A double break is made at each pole, spring-seated butt contacts assuring a firm closure. A small double pole, double throw switch operated by the contact mechanism provides a simple telltale, indicating the position of the breaker contacts, by lighting a red or green lamp. The tanks are of welded seam boiler steel, filled with oil and fitted with a thick lining of specially treated insulation which encloses the contacts. The terminals are of the condenser type, and allow the line wires to be brought in directly from overhead.

The 110,000-volt breakers for the Southern Power Company are of both the hand and electrically-operated types. They are normally closed by energizing the operating solenoid from a low voltage local circuit, but may also be hand-operated by a lever handle through a simple mechanical connection. Series relays, mounted on suspension insulators and inserted directly in the line, are provided for automatically tripping the circuit-breakers in case of overload. A wooden rod transmits the movement of the relay armature on the suspension insulator to the latch mechanism, providing a simple and quick-acting mechanical release effected directly by the line current.



110,000-VOLT WESTINGHOUSE CIRCUIT-BREAKERS DURING INSTALLATION.

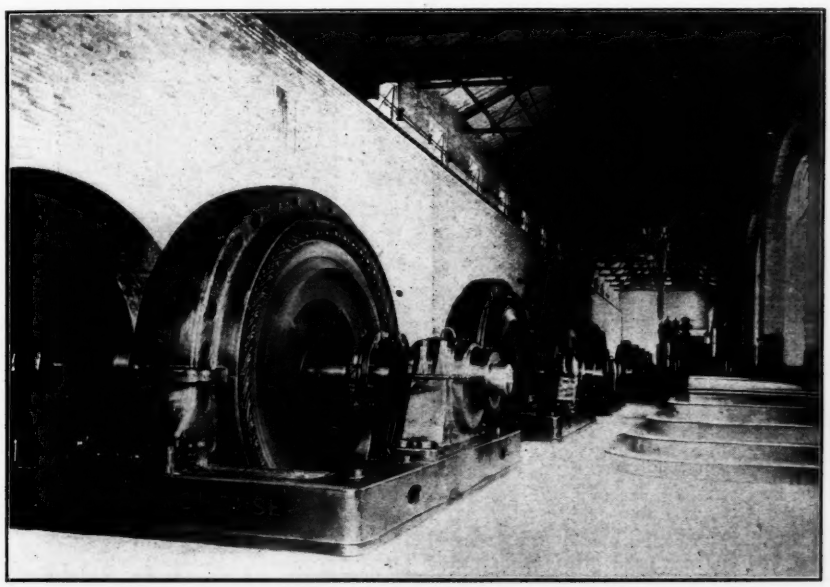


WESTINGHOUSE CIRCUIT-BREAKERS INSTALLED ON SOUTHERN POWER COMPANY'S LINES.

In the case of the Southern Power Company's lines not only is the voltage interrupted remarkable, but the magnitude of the currents being successfully handled under these severe conditions marks a step in the design of high-tension control apparatus. In this connection it is interesting to note the rated limit of operation of these 110,000-volt circuit-breakers; viz., that they shall successfully interrupt any short circuit that may occur on a transmission system of 120,000 kilowatts capacity.

Fifteen breakers of type and construction similar to the 110,000-volt apparatus will also be installed by the Southern Power Company for controlling its 88,000-volt transmission circuits. These breakers will be electrically operated and have their tripping coils energized from series transformers "built-in" around the terminals and mounted as part of the tank case as shown in the accompanying illustration. This disposal of the series transformers contributes to the compactness and self-contained character of the breaker group, avoiding all external transformer or relay devices and the incidental wiring.

The 44,000-volt lines of the same company are controlled by five sets of breakers of form similar to the high voltage apparatus already described for operation on the lower voltage transmission lines.



GREAT FALLS GENERATING STATION, SOUTHERN POWER COMPANY.

The 110,000-volt, 88,000-volt and 44,000-volt circuit-breakers described in the foregoing are of the type GA design, developed and manufactured by the Westinghouse Electric and Manufacturing Company. Elsewhere than the Southern Power Company these breakers are now in use controlling lines aggregating 200,000 kilowatt capacity, and ranging in potential from 44,000 to 88,000-volts in the plants of the Idaho-Oregon Power Company, Boise, Idaho; Spokane & Inland Empire Railroad, Spokane, Wash.; Niagara, Lockport & Ontario Power Company, Niagara Falls, Ont., and Societa Industriale Italiana, Milan, Italy, besides a number of installations yet incomplete.

### Tough Tungsten Lamps Pass Safely Through a Railroad Wreck.

The collision between a Pennsylvania eastbound passenger train and an idle locomotive that occurred just outside Jersey City on the morning of November 6th resulted in comparatively few injuries to the passengers, due to the fact that the strong frames of the passenger cars resisted crushing. The damage to engines and cars, however, was considerable. One of the steel passenger coaches jumped the track and turned over on its side, denting in the steel plates about eighteen inches.

In the lighting equipment of this car were nine General Electric tungsten lamps. It is interesting to note that after the wreck, when all the lamps were taken out and tested, these tungstens were found to be in perfect condition—a further proof of the rather remarkable strength and durability of the tungsten filament when specially adapted for train-lighting service.

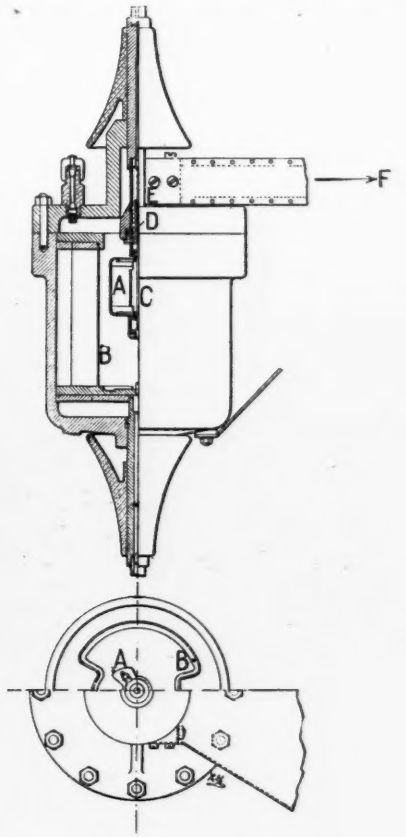
### Quick Switchboard Shipment.

A fire at Bass, Mich., destroyed the switchboard of the Bass Telephone Company. The Kellogg Switchboard and Supply Company, of Chicago, received the order for a new board at 10:35 Friday, November 26, and shipped the board complete on the first train Saturday, for Bass, which left at 10:30 a. m.

Exports of copper for the week ended December 16 were 5,475 tons. Since December 1 they were 14,661 tons, against 13,364 tons for the same period last year.

### Voltmeter for 200,000 Volts.

E. A. Watson has succeeded in constructing a voltmeter permitting the measurement of tensions up to 200,000 volts. Air compressed to fourteen atmospheres constitutes the insulation in this instrument, as oil would not be suitable for currents of such high pressures. The movable equipment of the apparatus is contained in a cast-iron receptacle, the cover of which is so arranged that the interior pressure contributes to keeping it closed. In order to prevent luminous discharges the needle *A* of the electrometer is made of thin copper sheet without sharp angles or corners. The shape of the needle and of the fixed part *B* of the apparatus have made it possible to obtain a graduation that is nearly proportional to the tension. The distance between the movable and fixed parts of the instrument increases with rising tension, reaching a maximum of two centimetres. The tension necessary for perforating a layer of air compressed to fourteen atmospheres is 400,000 volts per centimetre. A mirror is attached to the steel axle *C* and a ray of light projected on the same is reflected on a graduated scale *F*. The torsion exerted on the movable part is quite strong and



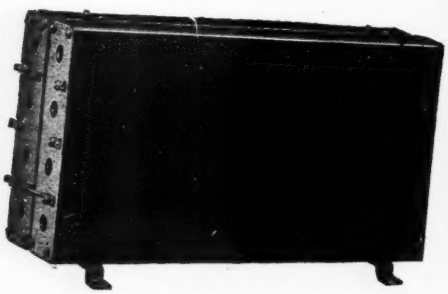

200,000-VOLT VOLTMETER.

is compensated by a spring *D.—From L'Electricien (Paris), October 30.*

### Printing Press Controllers.

The General Electric Company has developed a complete line of CR controllers designed to meet the requirements and severe service of small direct-current electrically operated printing presses. In their design special attention has been given to such necessary features as no-voltage protection, overload protection, push button stop and jog, ruggedness of construction, and accessibility.

All the controllers in this line have no-voltage protection. This consists of a contactor mounted in the lower left-hand corner of the slate front. The CR 169 has been designed so that upon failure of voltage the starting arm returns automatically to the off position. In addition the controller arm is provided with a moveable armature which may be adjusted so that the motor can be run only at a certain predetermined speed. All the other controllers of this line have been so designed that the contactor opens when the voltage fails and the contactor cannot be closed until the controller handle has been returned to the off position.



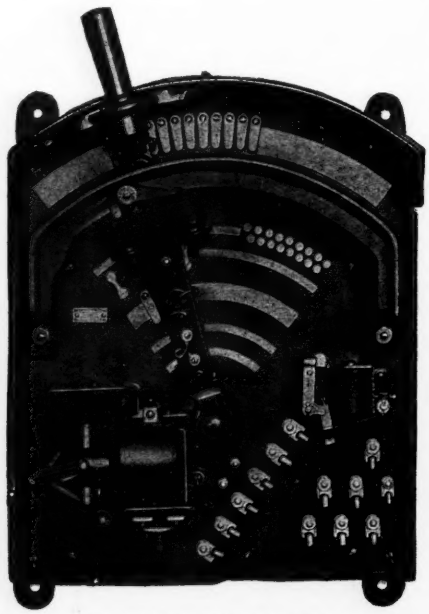
ARMATURE RESISTANCE FOR PRINTING PRESS CONTROLLER.

Since the armature circuit is made and broken by the contactor and not on the switch contacts, there is no arcing on the contacts. This eliminates the burning of the contacts which would necessarily result in roughening the surface, causing imperfect contact and the rapid destruction of the contact segments. The contactor is provided with a strong magnetic blow-out which extinguishes any arc that may result when the armature circuit is opened.

When the overload release is supplied in addition to the no-voltage release, it is so connected that when it operates it will de-energize the contactor coil, opening the contactor and thus breaking the armature circuit.

In many installations it is desirable to have push buttons located at various points around the press for stopping the motor, or for "inching" the press when necessary. Some of the controllers have, therefore, been designed to have both push button stop and jog, while others have the stop feature only.

If the push button is closed while the motor is not in operation the contactor will close, providing the switch arm is in the starting position, completing the armature circuit through the regulating resistance. This will start the motor which will run very slowly, as long as the push button is held closed. If the push button is closed while the motor is running, the contactor coil will be de-energized, thereby opening the motor circuit and stopping the motor. The same push button can therefore be used for jogging or stopping the motor. Each controller which has the stop and jog feature is furnished with two buttons; but any number of buttons may be installed.



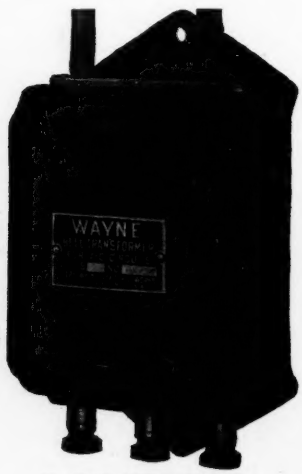
PRINTING PRESS CONTROLLER WITH COVER REMOVED.

Standard form P resistance units are used throughout. In the controllers having a field regulating resistance, the units are assembled upon the back of the slate front, while the armature resistance, whether for starting or regulating duty, is assembled in a separate box. When a dynamic brake is supplied the resistance is in most cases external, but in some controllers it is self-contained.

The controllers are provided with renewable segments for armature control, while button contacts are used for field control. The starting resistance is designed for starting duty only while the armature regulating resistance is designed for continuous operation, as various speed changes are obtained by varying the amount of resistance in the armature circuit.

### Wayne Bell-Ringing Transformer.

The transformer shown in the accompanying illustration is made by the Fort Wayne Electric Works, Ft. Wayne, Ind., for the purpose of utilizing alternating current for ringing electric bells, annunciators and similar apparatus. The transformer is built for 110-volt circuits, and has a secondary winding with taps brought out so as to obtain four, eight and twelve volts, depending upon the connections.




WAYNE BELL-RINGING TRANSFORMER.

In electric bell wiring, due to the fact that frequently the bell wires are run along the floor and are apt to be short-circuited, this transformer is designed so that it will run several hours on dead short circuit without danger of burning up. This feature makes the transformer especially valuable for this class of work. It is also designed so as to have ample capacity for ringing large size bells. The efficiency of this device is exceedingly high for a transformer of this size. The core losses are so small that it is a difficult matter to measure them, running approximately .4 watt.

The primary leads consist of two rubber-covered flexible cables brought out through an insulating piece, and this piece is anchored inside the case, preventing any injury to the winding, due to pulling of the leads. The secondary terminals consist of three binding posts giving three combinations of voltages.

This is the maximum combinations which can be obtained through this number of binding posts.

The casing is of cast aluminum with a heavy coat of black japan, making it very ornamental. This allows the transformer to be installed in places where the appearance of the dry cells would not permit of them being placed. The casing is so built as to have an air space between the body of same and the wall upon which it would be mounted. The core and coils are thoroughly impregnated and the same care and quality of material is used in the construction of transformer as in the large high-voltage transformers. It is in every way a thoroughly built transformer and only the best material and workmanship enter into its construction.

### An Electric Fireless Cookstove.

A new form of electric cooker, invented by Sebring Phelps and called the "electric fireless cookstove" has recently been put on the market by The Electric Fireless Cookstove Company, of Hastings, Mich. The makers of this electric stove guarantee that provided their directions are correctly followed, the cost of electric cooking with this stove is much cheaper than cooking with gas,—for electric power at four cents a kilowatt-hour as compared with gas at $1.00 a thousand cubic feet.

The illustrations given herewith show two views of the "Favorite," one of the several types of the electric stoves made by the firm. This is a two-element stove, but with the use of the lower or floor case it is claimed that as large a dinner can be cooked as with a four-hole gas stove with oven. Practically no attention is required between the operations of putting the food in the stove and the taking out of the same when it is fully cooked.

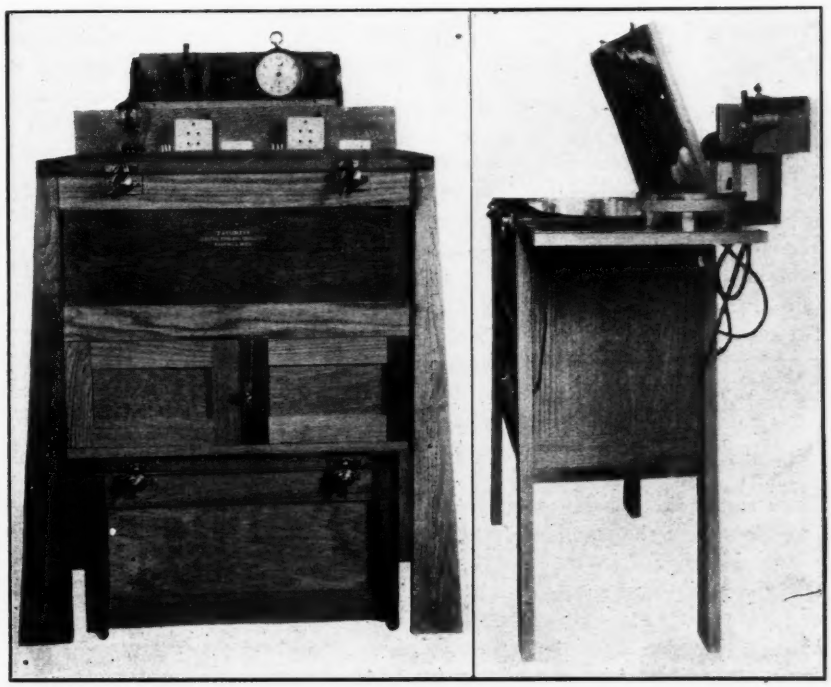
The following account, abstracted from an article in the *Hastings* (Mich.) *Banner*, November 10, 1909, gives some idea of the possibilities and method of operation of the electric fireless cookstove:

"An hour and a half before we came to Mr. Phelps' workshop, he had heated to a high degree one of the cooking elements by which the cooking is done. This element is raised to a high temperature by turning on the electric current from fifteen to thirty minutes according to the temperature desired. The cooking element was placed, after heating, above a chicken which was to be cooked. The heat from the element, from which the current was now shut off, had been cooking a chicken in the cooker for upwards of an hour before our arrival. When we came on the scene, the cooking was well-nigh completed.

"The cooker we saw had two heating elements. Mr. Phelps next, for thirty minutes, turned on the current for the second heating element. Then Mrs. Phelps brought out a tin of biscuits. This was placed in the cooker, the heating element being placed above, but not in contact with, the element. No current was used at all from this time on; but in fifteen minutes by the watch the biscuits were nicely baked in the cooker by the heat from the element.

"The cooking and baking were both going on in the same space in the cooker. This space was lined with asbestos underneath a bright metal cover. We were served with a delicious chicken sandwich which had been prepared from the biscuit and chicken cooked in the same space in the cooker, both baking and cooking going on at the same time. The electricity was used for thirty minutes in one case and for but twenty in the other. The meter told the expense, which was much less than what it would have cost for gas in a gas range."

The results of a series of tests by Mr. and Mrs. Sebring Phelps, showing the comparative costs of electricity (in the fireless cookstove) *versus* gas (in a gas stove) are given below. A guarantee is offered by the makers that these figures can be duplicated by anyone using the electric fireless cookstove, provided that their directions for the operation of the stove are followed, and that the voltage of the circuit is regular and constant.



FRONT AND SIDE VIEWS OF ELECTRIC FIRELESS COOKSTOVE.

The stoves are all built of white oak, thoroughly seasoned, and nice enough for a dining room, as may be noted from both of the accompanying illustrations.

| Kind of Food | Feet of gas used | Watts of electricity | Time in minutes required for cooking: Gas | Time in minutes required for cooking: Electricity | COST: Gas @ $1.00 per 1000. | COST: Electricity @ 4c a kw.-hr. |
|---|---|---|---|---|---|---|
| 6-lb. roast | 71 | 500 | 125 | 180 | $0.071 | $0.02 |
| 12-lb. goose | 107.5 | 1000 | 210 | 210 | .1076 | .04 |
| 2 apple pies | 27 | 507 | 25 | 35 | .027 | .02028 |
| 2 pans biscuits | 15.6 | 394 | 14 | 12 | .0156 | .01576 |
| 4 loaves bread | 32.3 | 665 | 60 | 90 | .0323 | .0266 |
| 1 loaf cake | 22 | 266 | 35 | 35 | .022 | .016 |
| 3-layer caks | 15.5 | 446 | 15 | 10 | .0155 | .0178 |
| 1 rice pudding | 20 | 266 | 35 | 35 | .02 | .016 |
| 8 quarts boiled potatoes | 14 | 258 | 56 | 56 | .014 | .0103 |
| Squash | 7 | 133 | 35 | 45 | .007 | .00532 |
| Cabbage | separate | | 60 | | | |
| Tomatoes | 15 | 346 | 20 | 60 | .015 | .0138 |
| Sweet corn | utensils | | 20 | | | |
| Totals | | | | | $0.3470 | $0.20186 |

Saving of electricity over gas $0.14.

### Maximum Demand Meters.

TO THE EDITORS:

Our attention has recently been drawn to an article in your journal (Vol. 55, No. 3, p. 110) on "The Compilation of Load Factors." In this article it is stated that no cheap and efficient maximum measuring instrument suitable for alternating-current circuits is on the market at the present time. We shall be much obliged if you will kindly allow us to contradict this statement through the columns of your paper, as we ourselves among other firms have been manufacturing such an instrument for some time past.

Under the circumstances a description of our maximum demand meters may be of interest to your readers. The apparatus consists of two separate parts, the meter proper in which the ordinary counter mechanism is combined with a maximum indicator and scale, and an automatic time switch. These two separate parts are connected electrically; they can be mounted either side by side, or one above the other, as required.

These meters are also manufactured in another form in which the meter and the time switch are combined under one cover. This latter form is constructed solely for alternating-current circuits.

The construction of the meter itself only differs from the standard form in the inclusion of the maximum recording mechanism. This consists, in addition to the ordinary counter mechanism, of a circular scale and moving pointer. The pointer is operated by a carrier which in turn is set in motion by a tooth wheel on the counter gearing shaft. The tooth wheel is coupled to the carrier by means of the armature of an electromagnet fixed at the side of the apparatus. At regular intervals (for instance, every fifteen minutes) the time switch momentarily short-circuits the current in the magnet coil, whereupon the coupling is disconnected and the carrier is brought back to the zero position by means of a spring. The maximum indicator, however, remains in the highest position which it had previously reached; it will be set in motion again as soon as the current exceeds its former maximum value.

The apparatus is equally suitable for either direct or alternating-current circuits.

ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT.

Berlin, Germany, November 29, 1909.

### Electric Drive in Automobile Works.

In line with the ideas of all progressive manufacturers the automobile makers of the country are rapidly installing motor drive for the various machines in their shops. One company alone, the Allis-Chalmers Company, has furnished considerable electrical apparatus to the automobile manufacturers in the neighborhood of Detroit, Mich., some items of which follow. The Everett-Motzger-Flanders Company, Detroit, Mich., has purchased three 300-kilowatt generators with exciters, four 100-kilovolt-ampere oil-filled water cooled transformers and sixty-four induction motors. This company uses a 30 horsepower motor running at 850 revolutions per minute as standard, and thus has to carry but few repair parts.

The Oak Park Power Company at Flint, Mich., owned and operated by the General Motors Company and which furnishes power to the numerous plants of the company, has recently installed two 1,000-kilowatt steam turbine units with direct coupled exciters, one non-condensing, the other condensing, with turbo jet condenser and motor generator exciter set; two 200-kilowatt alternators with exciters, twenty-one transformers and a large number of motors.

The Weston-Mott Company of Flint, Mich., has purchased a large number of induction motors. It has adapted a 40-horsepower motor running at 850 revolutions per minute as standard, and one of these usually drives a group of machines.

The Kelsey Herbert Wheel Company of Detroit has put in three transformers and six induction motors.

The Rapid Motor Vehicle Company, Pontiac, Mich., has put a central generating station in operation. This consists of two 20 and 40 by 42 inch engines direct connected to 600 kilowatt, sixty cycle, three-phase, 240-volt generators. Excitation is furnished by a forty-five kilowatt induction motor generator set or by a forty-kilowatt engine exciter set.

The American Motor Castings Company has installed a 100-kilowatt engine generator set and six induction motors.

The Brush Runabout Company, Detroit, Mich., has purchased three 100-kilowatt transformers and twenty induction motors. This company has adopted twenty-horsepower motors running at 850 revolutions per minute as its standard.

It has been found that motor drive helps to reduce factory cost to a considerable extent, and it is quite probable that many other automobile manufacturers will be following the example set by those mentioned, where electrical operation is not already used.

### Japanese Government Buys More American Telephone Apparatus.

Another telephone-switchboard order from the Far East has been placed with an American firm of manufacturers. The Western Electric Company has secured a contract from the Japanese Department of Communications for the equipment to extend the service in the capital city of Tokyo. This board is of the sort used by the Bell companies in this country and in general use abroad. It is a common-battery switchboard of the most up-to-date type.

This firm also contracted recently to supply the Chinese government the equipment for the first two modern telephone exchanges in the empire, to be located in the city of Pekin.

### Electric Cooking versus Gas.

Some elaborate researches have been made in Germany, says *The Electrical Engineer,* of London, Eng., with reference to the comparative cost of cooking by electricity and by gas. It appears from the average of a very large number of experiments made under varying conditions that if the cost of a kilowatt is more than half as great again as that of a cubic metre of gas (thirty-five cubic feet) the gas is the cheaper heating agent. Otherwise electrical heating is the more economical. It is claimed that the use for which electrically generated heat is least suitable in the household is for boiling water.

### Independent Telephone Rates Raised.

As a consequence of fear of raise of rates, the minority stockholders of the United States and Cuyahoga Telephone companies have filed petitions for a receivership. Their move, however, was anticipated by B. H. Mahler, a director of the United States company, who raised the rate to more than double that asked by the Bell company. Mr. Mahler, it is reported, will head the Cuyahoga and United States Telephone companies if they are taken over by the Bell interests.

# Current Electrical News

## GREAT BRITAIN.

*(Special Correspondence.)*

LONDON, DECEMBER 11.—The approach of a general election has once more raised the question of protection in relation to the electrical industry in Great Britain. In the ordinary course of events, the Institution of Electrical Engineers steers clear of politics, although there are many members who hold the view that the Institution is being managed on too severely scientific lines, and that it ought to take a more active interest in commercial matters. However, be this as it may, political questions are strictly taboo at the meetings of the Institution ,and as a rule there is little opportunity for the politicians of the Institution to have much to say there. On Thursday, however, the Council allowed a paper to be read which made comparisons between the electrical industry in Germany and in England, and, as was inevitable, it gave the opportunity for the introduction of politics. Emile Garcke, of the British Electric Traction Company, made a rousing speech in favor of tariff reform as a solution of many of the difficulties under which the industry is now suffering. He was severely rebuked by Gisbert Kapp, the President, who vetoed any further remarks of a similar character. Nevertheless, several other speakers managed to air their political views, and there was just a danger of some feeling being exhibited. The Council of the Institution is strong in its determination to remain strictly impartial on this matter. As this attitude is being persisted in, much against the will of a certain section, it is quite possible that an attempt will be made to form a society which will take in hand the commercial aspect of affairs. An Electrical League was mooted in the summer but nothing further has been heard of it; the idea, however, will probably be revived under the circumstances of a general election.

The London Electric Supply Act of 1908, which authorized agreements between the electric-supply authorities of London, is already bearing good fruit. A spirit of reasonableness seems to have taken possession of both municipalities and companies. Joint meetings of officials of companies and municipalities are being held to discuss technical matters, and a scheme has now been formulated for appointing a committee containing members from both sides to supervise the preparation and publication of publicity matter in relation to electricity supply. The idea is to produce literature suitable for all parties, in large quantities, and so save expense.

A somewhat daring method of advertising electricity supply has been adopted by the municipal electric engineer at St. Pancras, London. This consists of fixing large models of incandescent lamps, motors, etc., on the lamp posts. To anyone with a specially fine aesthetic taste, the idea might appear revolutionary, but the commercial spirit is seizing all our station engineers in no uncertain manner, and as the end is justifying the means, it is not likely that the residents will complain.

The Electrical Contractors' Association is already showing activity in regard to those municipalities who have given notice to apply for powers next session to carry out wiring work, etc. The Association has warned these municipalities that unless they promise to carry out this class of work through a contractor, they will oppose the bills when they come before Parliament.

Ever since the Edinburgh Corporation went in for an electric supply undertaking the Electricity Committee has always refused to offend the tastes of their rate payers by running the stations condensing. In this way, of course, they have dispensed with the use of cooling towers. The Corporation possesses two generating stations which have now become quite filled with plant. The consulting engineer has reported that the only alternative to the expense of a new high-tension generating station outside the town, is to convert the existing stations to run condensing and to install exhaust-steam turbines. At any rate, the scheme is now before the Council, and some English towns are to be visited where condensing plant is in use. It may be mentioned that the Edinburgh undertaking is probably the most successful of any electric supply works in the kingdom.

It is reported that the United Wireless Telegraph Company of America has decided to build works near Liverpool. G.

## CONTINENTAL EUROPE.

*(Special Correspondence.)*

PARIS, DECEMBER 9.—One of the large mining companies in France, known as the Boucher du Rhone Company has recently completed a large plant for use at the Aygalades mines in the Mediterranean region. Here is installed a substation of some size, and it receives current over a power line from the Brillanne hydraulic plant. There are erected two transformer posts and two substations with rotary converters in order to supply current for the mine for lighting and electric locomotives. At present there are ten of these nine-ton locomotives in operation at the mine, each carrying two sixty-horsepower motors. Motors also drive a cable drum plant for taking out the material. At the company's shops located at Madrague, in the neighborhood of Marseilles, there is installed a transformer post for operating the various motors of the shops.

The new hydraulic plant which is in the course of erection in the southern part of Austria in the region of Fiume, will be one of the largest in Europe, as it is intended to give 80,000 horsepower. It is installed by the Adriatic Electric Company, with the use of French capital for the most part. The station is to supply an extensive network of power lines, taking in the city of Trieste as well as Agram and Pola. Current will be used for locomotives which it is proposed to introduce upon some of the sections of the Austrian state railroads.

Orders have already been placed for a part of the material for the great turbine plant which is now being built at Rjukan, Norway. This includes five three-phase alternators to be built by the Brown-Boveri firm. These machines are of 17,000-kilowatt capacity and work on 10,000 to 15,000 volts. The same number of 14,000 horsepower turbines has also been ordered. The present outfit is one-half of the ultimate capacity of the station.

Measures are being taken to adopt the electric system on the Metropolitan lines in the city of Vienna. It is estimated that the undertaking will involve an outlay of $10,000,000. The Siemens-Schuchert Company are likely to obtain the contract for this work. As regards the operation of the lines, it will no doubt be carried on by the municipality.

The city of Parma, Italy, is considering a project for the building and operation of several sections of city and interurban traction lines. A. DE C.

## IMPORTANT DEVELOPMENTS.

*(Special Correspondence.)*

LARGE POWER PROJECT—A company has been organized at Woodstock to harness the Staunton river at Brookneal, two miles from Lynchburg, Va. The plant, it is estimated, will deliver 5,000 horsepower. The president of the company is M. Coffman, cashier of the Shenandoah National Bank. L. T. Stoneburner, secretary and treasurer. The capitalization of the company is limited to $1,000,000, on which a charter fee of $750 has been paid.

POWER PLANT FOR MEXICO.—The Mayo River Power and Land Company has made surveys for a dam across the Mayo River in western Chihuahua, Mex. This dam, which will be the first of several, is to be located abouty fifty-six miles above Navajoa, Sonora, on the new Southern Pacific railroad. About 25,000 horsepower will be developed by the first dam, but the amount will be considerably increased when the subsequent dams are built.

WORK TO BEGIN ON TUM TUM ROAD.—A. Arnston, general manager of the Tum Tum Railway at Vancouver, Wash., has announced that work will start on the road about the first of January. A section four miles long between Ridgefield and Tum Tum Mountains will first be constructed and will be finished before July 1. Sixteen miles of the total forty-five will be in operation within a year. Power will be furnished by a hydroelectric generating plant.

COLORADO RIVER DAMS IN CONSTRUCTION—Preparations are being made to replace the $1,600,000 granite dam across the Colorado River, which was washed out in 1906, with a reinforced concrete structure. At the Marble Falls on the Colorado River a dam is at present being built and power will be supplied to Austin, San Antonio and other cities. Approximately 25,000 horsepower will be developed and it will be distributed within a radius of 100 miles. A large dam across the Llano River has just been completed and the hydroelectric plant is supplying light and power to the city of Llano.

TO DAM THE DIX RIVER.—The Madison Electric Power Company of Richmond, Va., is promoting a plan for the development of power from the Dix River near Burgin, Ky. It is the intention of the company to construct an immense dam in the river below the bridge at Camp Dick Robinson. The base of the dam is to be 156 feet, 150 feet high and 500 feet long. The estimated cost of the undertaking will be $1,000,000, and it will require one year to complete the work. When completed, the power plant will have a generating capacity of 25,000 to 30,000 horsepower, which will be sufficient to supply a number of surrounding towns with light and power.

NEW POWER PLANT FOR MENOMINEE RIVER—There is a project at present under way for damming the Menominee River near Marinette to secure power for the mills of the Menominee and Marinette Power Company. The company which is promoting the scheme is capitalized at $1,000,000 and makes a claim that 6,000 horsepower will be developed. The company is backed by Harry J. Brown, Elmer Grimmer and other well-known men.

POWER PLANT FOR THE OCONEE RIVER.—A company is to be formed for the development of an estimated 4,000-horsepower waterpower on the Oconee River, near Athens, Ga., those interested being Capt. James White, J. Y. Carithers and others, of the Athens Electric Railway System. The power generated will be utilized in operating an addition to the Star Thread Mills at Barnett Shoals, on the Oconee, doubling the mill's capacity, while power will also be developed for a new $500,000 cotton mill to be erected. The total development will represent over a million dollars. Extensions to the Macon Street Railway System will furthermore be supplied with power from the new hydroelectric development, which will be one of the largest in this section of Georgia.

## LIGHTING AND POWER.

*(Special Correspondence.)*

PLAQUEMINE, LA.—J. H. Pugh has purchased the franchise and property of the Plaquemine Electric Light and Power Company. P.

SAN ANTONIO, TEX.—Ira C. Rinehart is organizing an electric light and power company for this place, to put in a plant to cost $105,000. P.

EVANSVILLE, IND.—Hal C. Kimbrough, of Muncie, Ind., and associates, have applied for a franchise for a heat, light and power plant in Evansville. S.

SULPHUR, OKLA.—The Swanson Electric Company, which recently purchased the plant of the Sulphur Light and Power Company, is rebuilding the entire plant.

HARTFORD, WIS.—The new electric power plant of the Kissel Motor Car Company here has been put into operation. It will be used to operate the company's factory. M.

DECATUR, ILL.—The Progressive Light and Power Company has been incorporated with a capital of $100,000, to generate and sell electricity. The incorporators are: W. H. Suffern, R. I. Hunt and F. M. Ives.

HOUSTON, TEXAS.—The distributing lines of the entire lighting system inside the fire limits of the city are being placed in underground conduits. The installation is being made by Ford Bacon and Davis of New York city at a price of approximately $300,000.

SYRACUSE, N. Y.—The Wayne County Electric Company, capitalized at $100,000, has been sold by Syracuse capitalists to William T. Morris and associates, of Penn Yan. The company supplies lighting in Lyons and Clyde.

SEYMOUR, IND.—The city council has granted a franchise to the Indiana Public Utilities Company, of which W. B. Hotten is secretary, for the erection, equipment and operation of a new and up-to-date electric light plant. S.

FREEPORT, ILL.—The Commonwealth Electric Company has been incorporated by Charles E. Gregory, Richard Armstrong and C. R. Norwood, all of Chicago. It is proposed to have the lighting plant in operation by spring.

NEW ORLEANS, LA.—An ordinance has been passed permitting the reorganization of the Consumers' Electric Company. An additional investment of approximately $1,000,000 will be made when the new company is formed.

MADISON, WIS.—The Hustisford Electric Light and Power Company of Hustisford has filed articles of incorporation here. The company has a capital stock of $40,000. The incorporators are E. J. Dehne, O. E. Dehne, and C. W. Erdman, Jr. M.

FRESNO, CAL.—Articles of incorporation have been filed by the Coalinga Water and Electric Company, with a capital of $2,000,000, to supply water and power to Coalinga and the oil fields. The directors are: W. C. Kerckhoff, A. C. Batch, K. Cohn and A. G. Weston.

DELPHI, IND.—The city council has granted a franchise to the Fort Wayne & Wabash Valley Traction Company to furnish light and power to the citizens of Delphi. The minimum rate for residences is seventy-five cents a month, the company to furnish meters for all consumers.

JACKSON, ALA.—It is reported that the Jackson Electric Light and Power plant, owned by Frank Jones and General Carnes of Memphis, has been sold to F. B. Prout and H. H. Carson of the General Electric Company and local capitalists. The price paid is given at $1,000,000.

SALEM, ORE.—State Engineer Lewis will grant the application of W. B. Winans for a permit to appropriate the waters of Hood River for power purposes. Mr. Winans has projected an electric railroad for the Hood River Valley and plans to develop 20,000 horsepower to operate the line.

OLD TOWN, ME.—The Kennebec Development Company has been organized for the purpose of generating and supplying electricity and gas for lighting, heating, mechanical and other purposes, with $200,000 capital stock. The officers of the company are: O. H. Briggs of Providence, R. I., president; E. H. Green of Waterville, treasurer.

REDDING, CAL.—The Sacramento Valley Power Company of this city has given a deed of trust to the Central Trust Company of San Francisco to secure the payment of bonds amounting to $500,000. The company virtually mortgages all its water rights, real estate, power lines, power houses, machinery and property of every description.

ONAGA, KAN.—The Onaga Heat, Power and Light Company has been granted a charter by the state board at Topeka, with Peter Gurtler, president, and L. L. Omeara, secretary. Ground also has been purchased for the location of the building and contracts let for the machinery. It is expected that the plant will be in operation by January 1.

TACOMA, WASH.—Articles of incorporation of the Cle Elum Traction Company have been filed with the county auditor by Frank S. Farquhar and M. E. Farquhar. The object of the company is to construct transportation lines within and without Cle Elum and Roslyn in Kittitas County and to establish branch lines. The capital stock is $300,000.

REDDING, CAL.—The Sacramento Valley Power Company has completed the survey of its pole line from Redding through Red Bluff, Tehama and Corning to Chico. Material for the construction of the line is being delivered at Redding, Red Bluff and Chico, and construction crews have begun building south from Redding, north from Chico and in both directions from Red Bluff.

SEYMOUR, IND.—The city council has been enjoined temporarily from entering into a contract with the Indiana Public Utilities Company for street lighting. The injunction was secured by the Merchants Electric Light Company, whose contract has expired. The Indiana Public Utilities Company is proposing to build and equip a new plant and the fight has been very bitter. S.

HAMMOND, IND.—Plans for an electric light plant to cost a quarter of a million dollars are now in preparation for C. H. Geist, owner of the present plant in this city. The new plant will have 12,500 horsepower whereas the present plant that supplies Hammond with electric light has only 4,000 horsepower. The power company is to furnish the Gary and Interurban Railway Company with power.

NORWICH, CONN.—The Falls Company, Norwich, Conn., has completed the installation of the two water-wheels at its dam on the Yantic River, and will erect a new power house for its electric generator for the purpose of supplying its mill with electricity. After the water passes these wheels it will be again utilized at the lower dam of the company to turn the wheel of the mill proper. About 200 horsepower will be generated to operate twenty-two machines in the picker room.

DELPHI, IND.—The City Council has granted to the Fort Wayne and Wabash Valley Traction Company a fifty-year franchise, under which the county seat of Carroll County will be supplied with electric current for lighting and power from the Fort Wayne station, ninety-five miles distant. The work of making connections will begin at once, and until the new station at Lafayette, some fifteen miles west of Delphi, is completed, all the current for Delphi will be supplied from the Fort Wayne station.

YORK, PA.—A movement has been started here to build a municipal lighting plant. The light committee of city councils has been instructed to secure estimates of the cost of lights in other cities, and also the cost of the erection of a municipal plant. This action has been taken because the company which has been furnishing light to York has submitted a bid $11 per lamp in excess of last year's, and will not sign a contract for less than five years. It is estimated that a plant erected by the city would cost about $200,000.

SYRACUSE, IND.—The Syracuse Power and Light Company has filed articles of incorporation with a capital stock of $30,000. The object of the company is to supply cities, towns, communities, farmers and places of amusement with light, heat and power. Joseph P. Dolan, Lewis A. Neff, Herman D. Boozer, Charles Crow and A. B. Dolan are the incorporators. The above corporation is constructing a power dam in Elkhart River and will generate electricity to be transmitted to towns, cities, farmers and communities in Elkhart and Kosciusko counties. S.

ALBANY, N. Y.—The East Creek Electric Light and Power Company has asked the Public Service Commission for authority to execute a mortgage upon all its property for $3,000,000, and to issue bonds to the amount of $2,080,930, and capital stock to the amount of $550,000. The company now has its water power at East Creek, Herkimer County, and supplies electricity for light and power at St. Johnsville, Fort Plain, Canajoharie, Nelliston and Palatine Bridge. It has been offered a contract with the Fonda, Johnstown and Gloversville Railroad Company for the furnishing of a large amount of the power for that railroad company, and the proceeds of the sale of stock and bonds, outside of the refunding of outstanding bonds, is to be devoted to the extension of its water power.

KIMBALL, W. VA.—The surveys have been completed for the construction of a power house to light and furnish water for the city. It is estimated that the combined plant will cost $100,000.

RHYOLITE, NEV.—Leonard Davis, general manager of the Buckeye Mill and Mining Company, at Fish Springs, will put in an electric plant on Birch Creek to furnish power for the mill now being installed there.

CHIHUAHUA, MEX.—The Guanajuato Light and Power Company has increased its capital from $6,000,000 to $12,000,000. This increase was demanded by the extension of transmission lines and erection of new plants.

WILMINGTON, DEL.—The Wilmington City Electric Company has purchased a 1,500-kilowatt turbine generating set, which has been recently placed in operation. The contract price of the machine was about $20,000.

LOS ANGELES, CAL.—The City Council has passed a resolution calling for $3,500,000 to be issued in bonds for constructing works for generating and distributing electricity for purpose of supplying the city with light, etc.

LYNN, MASS.—An appropriation of $30,000 has been made by the city for improvement of the municipal lighting plant. Two 100-kilowatt turbine-driven generating sets will replace the four arc lighting machines now in use.

RICHMOND, VA.—An additional appropriation of $65,000 has been made to complete the construction of the overhead system in connection with the municipal power and lighting plant. The original bond issue was $350,000.

PALO ALTO, CAL.—Plans have been completed for a new street lighting system for which $3,500 has been voted. The principal streets are to be lighted with arches containing twelve lights each and spaced about 100 feet apart.

MONROE, WIS.—It is reported that a controlling interest of the Monroe Electric Light and Power Company is to pass into the hands of parties represented by H. A. Smith of Chicago. The change will take place about January 1.

AMHERST, WIS.—A new water wheel which will generate about ninety horsepower, or double to the amount formerly obtained, has been installed at the electric light plant at Amher t. A new concrete flume has also been built. M.

INDIANAPOLIS, IND.—The city council has passed an ordinance requiring the railroads to pay thirty per cent of the cost of arc lights placed over railroad street crossings. The railroads are quite willing to comply with the ordinance. S.

BUFFALO, N. Y.—The City Hall lighting plant was put into operation a short time. The generating machinery consists of one 50-kilowatt, one 75 and one 150-kilowatt generator. Work on this installation was carried out under the direction of J. J. O'Leary.

EVERETT, WASH.—The Granite Falls Electric Company of Granite Falls has filed a petition with the Board of County Commissioners of Snohomish county, asking for a franchise to construct and maintain upon the roads of the county an electric transmission line.

YORK, PA.—The new 750-horsepower engine and generator have been installed in the powerhouse of the York Railways Company. President W. T. Bay Stuart says that there will be no future trouble and that all public power demands will be supplied. O.

PESHTIGO, WIS.—The Northern-Hydro Company, which is to supply electric power to Manitowoc and Two Rivers, has placed a trust deed for $5,000,000 on its property. It is understood that the American Trust and Savings Bank, of Chicago, has furnished the money. C.

SAN DIEGO, CAL.—The San Diego Consolidated Gas and Electric Company has been awarded the contract for lighting the streets for a period of five years beginning with June 1, 1910. The present rate is $7 per month per lamp whereas the new rate is $5 per lamp per month.

SUPERIOR, WIS.—A mortgage for $100,000 has been filed by the Northern Power Company. The mortgage is held by the Great Northern Power Company, a Minnesota corporation. The mortgage was made to reimburse the Great Northern company for improvements made on behalf of its subsidiary.

SACRAMENTO, CAL.—Articles of incorporation of the Western Consolidated Coal, Gas and Electric Company have been filed recently. The company is capitalized at $7,500,000, and is now operating in Arizona. It intends to develop extensive coal claims near Stone Canyon, Cal., but may supply power and light to any part of the state.

SPOKANE, WASH.—Contracts for doubling the capacity of the Nine Mile power plant of the Inland Empire system have been let to the Westinghouse company and the American Wheel Company, and when complete the station will have a capacity of 20,000 horsepower. The machinery will be installed as rapidly as it arrives on the ground.

CHARLESTON, N. C.—The Consolidated Company is inviting bids from the General Electric Company and the Westinghouse Electric Company on a 1,000-kilowatt steam turbine, to take care of its lighting business; the same to be delivered within the next five or six months. This step is necessary to take care of the increased lighting and power business.

REDDING, CAL.—The Sacramento Valley Power Company, which operates three power houses in this county, has executed a deed of trust to the Central Trust Company of San Francisco to secure the payment of bonds for $500,000. The proceeds of the bond issue will be used for the extension of the company's power wires to various points in the Sacramento Valley.

NOBLESVILLE, IND.—The White River Light and Power Company, whose hydroelectric plant will be completed in about two weeks, is making a large number of contracts to furnish power to factories and industries requiring cheap power. The company is contracting to furnish power and light at five cents per kilowatt-hour. This remarkably low rate is attracting a number of industries to Noblesville. S.

ALBANY, N. Y.—The Floral Park Light, Heat and Power Company, has recently been incorporated to carry on operations particularly in the counties of Nassau and Suffolk. The capital stock is placed at $10,000, and the directors are William C. Baker, Charles A. Lockwood, E. B. Lockwood and Charles E. Twombly of Jamaica, William L. Wood and R. W. Kellogg, of Hollis, and John Ebbers of Union Course.

FT. WAYNE, IND.—Certain cars now in operation by the Ft. Wayne & Wabash Valley Traction Company are being commended very highly by passengers on account of their excellent lighting system. The company has equipped these cars with a new light which is an adapation of the tungsten and promises to be a great success. The filaments are short and heavy to prevent breakage from the jar of travel. Numerous inquiries are coming to the management relative to the success and durability of the light. S.

FT. WAYNE, IND.—President J. Levering Jones of the Ft. Wayne and Wabash Valley Traction Company, in an open letter addressed to Mayor Hosey, asserts that the city is operating its electric light plant at a big loss, and as the traction company is one of the largest taxpayers he protests against it being taxed to maintain a competitive plant on a losing basis. Mr. Jones asks that experts be appointed to inquire into and report on the matter of the municipal plant being a losing proposition. The advocates of the municipal plant charge the traction company with conspiring to discredit the municipal system and subsequently buying it in and thus secure a monopoly of lighting in the city. S.

## ELECTRIC RAILWAYS.

*(Special Correspondence.)*

CHIPPEWA FALLS, WIS.—It is reported that C. R. Brant, of Madison, Wis., and his associates are considering the construction of an electric railway to La Crosse, via Galesville. C.

BOZEMAN, MONT.—The Gallatin Valley Electric Railway Company will build a twenty-five mile extension from Bozeman, Hot Springs northward through Belgrade to the Dry Creek territory. C.

MEDORA, N. D.—The Northern Pacific Railway Company has a crew of engineers at work in the Bad Lands with a view to the electrification of a considerable portion of the road near Little Missouri. C.

EAST TROY, WIS.—John I. Beggs, of the Milwaukee Electric Railway and Light Company, states that work on the extension of the electric railroad to Fayette, Elkhorn and Delavan will be started in the spring. C.

REDWOOD CITY, CAL.—Preliminary surveys are being made for an electric railway from this city to La Honda. The main backer of the proposed railroad is A. Schiling, of the Stauffer Chemical Company.

CLARINDA, IOWA.—W. S. Farquhar, I. H. Taggart, Jos. A. McKinley and others have incorporated the Iowa & Southwestern Railway Company, with a capital stock of $300,000, to build an interurban to Blanchard, Iowa. C.

MILWAUKEE, WIS.—The Milwaukee Western Electric Railway Company has been granted permission to construct a line to Beaver Dam, Wis., a distance of fifty-six miles, with a division from Sussex through Pewaukee to Waukesha. C.

ST. LOUIS, MO.—J. M. Longenecker, acting for the minority bondholders of the Toledo & Indiana Railroad, has purchased that road at public sale for $1,006,000, or $99,000 more than the appraised value. The sale cancels an issue of $2,000,000 of stock.

MINERAL WELLS, TEX.—At a meeting held at the Crazy Wells $21,000 was raised to aid in building an interurban railway between this city and Fort Worth. A bonus of $60,000 is to be raised and held by trustees until the road is in actual operation.

ZANESVILLE, OHIO.—The survey of the Zanesville & Meigs Valley traction line has been completed and the financial end of the company will be arranged in a short time. It has been announced by officials of the road that the contract will be let by May 1.

BRIDGEPORT, CONN.—Twenty large double-truck closed trolley cars which are being built at Worcester for the Connecticut Company for use in the Bridgeport district will be delivered in January. The contract involves an expenditure of $132,000.

IOWA CITY, IOWA.—The Commercial club has raised $20,000 towards the construction of an interurban road to Davenport. C.

PASADENA, CAL.—The Pasadena Rapid Transit Company has secured all the right-of-way for their line between here and Los Angeles. The surveys have been completed and all that remains is the letting of the contract.

SANTA BARBARA, CAL.—The council has granted the petition presented by Atorney H. C. Booth, of the Santa Barbara Consolidated Railway Company, for a franchise for an electric street railway on State and Sola streets of this city.

SHEBOYGAN, WIS.—The Sheboygan Light, Power and Railway Company is planning to install a steam turbine of 1,500 horsepower at its plant at Sheboygan. The plant now can generate 2,500 horsepower. It was established about five years ago. M.

OAKLAND, CAL.—It has been announced that the Northern Electric Company will secure an outlet on San Francisco Bay and enter into competition with the Southern Pacific and Santa Fe systems for the interior traffic of the bay cities.

LOS ANGELES, CAL.—A meeting of the stockholders of the Los Angeles-Pacific Company will be held on January 6 to vote upon the issue of $20,000,000 in bonds, the proceeds to be used for improvements and extensions of the company's lines.

DELPHI, IND.—The Logansport, Frankfort & Indianapolis Traction Company has asked the commissioners of Carroll County for a franchise to construct an interurban line on the Michigan road through Washington, Burlington and Carrollton townships. S.

EVELETH, MINN.—E. M. Prindle and W. M. Prindle, of Duluth, have applied for a franchise to build an electric line between Virginia to this city. The company proposes to run passenger cars, with accommodation for freight, baggage and United States mail.

JANESVILLE, WIS.—The Janesville Street Railway Company has been sold to a corporation of New York capitalists, represented by Thos. F. Nolan, who will reorganize and reconstruct the entire system, increasing the trackage from five to ten miles and will put on new cars.

BINGHAMTON, N. Y.—As a result of a conference the railroad between Sayre and Towanda, Pa., is practically assured. The Towand interests by which the road will be built have already subsvcribed $200,000. When completed, this road will connect Elmira, Corning, Waverly and Binghamton.

RICHMOND, IND.—The Commissioners of Wayne County have refunded to the Terre Haute, Indianapolis & Eastern Traction Company $4,780 taxes paid to the county listed on the item of "cash on hand." The Supreme Court held that the cash on hand was included in an item covered by the State Tax Board, and should not be included by local tax boards. S.

MARTINSVILLE, IND.—The city council has refused to renew the franchise of the Capital Traction Company, which proposes to build a traction line encircling Indianapolis connecting Martinsville, Danville, Lebanon, Frankfort, Noblesville, Greenfield and Franklin —all county-seat towns. The council promised to renew the franchise as soon as the company commenced work on the road. S.

DENVER, COLO.—It has been announced that construction of the line from Grand Junction to Fruita would begin in a short time and that the road would be in operation by June 1. The line will be fifteen and one-half miles long and the newest type of interurban cars and electric locomotives will be used. The power question has been solved by the $60,000 addition to the electric light plant now under erection.

HOOPPOLE, ILL.—Arrangements have been completed by J. J. Burns of the Burns Construction Company, which is building the Tampico-Hooppole line, for an electric line from Tampico to Sterling and from Hooppole to Geneseo. The middle section from Tampico to Hooppole is completed to within three and a half miles from Hooppole, and this short remaining stretch will be completed as fast as the work can be done.

FREDERICK, MD.—A company with a capitalization of $1,500,000 will probably be formed from the consolidation of several trolley lines at present operating in this viciinty. The roads involved are the Washington, Frederick & Gettysburg Railroad Company, the Frederick & Middletown Railway Company and the Jefferson & Braddock Heights Railway Company. It is expected that extensions will follow such a combination.

CHEHALIS, WASH.—Articles of incorporation have been filed by the Pe Ell & Columbia River Railway Company. The company proposes to run an electric railroad from Pe Ell southerly to tap the Columbia River near Cathlamet. They propose to use all the prerogatives of a common carrier, both as to handling freight and carrying passengers. The incorporators are W. C. Yeomans, Charles L. Yeomans, C. A. Doty and F. B. Hubbard.

AUSTIN, TEX.—A charter has been filed by the Oklahoma, Red River and Texas Railway Company, of Clarksville, Red River County. The charter calls for an eighty-mile road between Blossom and Mineola, through Lamar, Red River, Hopkins, Franklin and Wood counties. The incorporators are C. P. Moore, Frank Miesch, James T. Brown, J. L. Skinner, John T. Upchurch, John Miesch, E. L. Canterbury, W. H. Dickson and Roscoe Johnson.

NORWALK, O.—There is a rumor at present that the northern and eastern Ohio interurban railway companies intend to merge their interests. The combinations if carried out will include the following: Lake Shore Electric, the Cleveland, Southwestern & Columbus, the Northern Ohio, the Youngstown & Ohio River, the Youngstown & Southern, the Stark Electric, the Cleveland, Painesville & Eastern, and possibly the Western Ohio and the Eastern Ohio.

LAWTON, OKLA.—A franchise has been granted to the Lawton and Fort Sill Electric Railway Company which proposes to construct a street railway line in Lawton and an interurban to Fort Sill and Medicine Park, a distance of twenty miles. The company paid the expense of the election and has up a cash forfeit of $5,000 in case the line is not in operation in twelve months. Col. David L. Sleeper and Simon Smith of Oklahoma City and W. H. Pattie of Tulsa are the builders.

MONTICELLO, IND.—Arrangements are being made to hold elections in four townships in White County to vote on the proposition of levying a subsidy tax in aid of the construction of an interurban road by the Indiana Northwest Traction Company. The line, as proposed, will start at Battle Ground, where it will connect with the Fort Wayne & Wabash Valley traction line, and extend to Monticello, Rensselaer, Hammond and Chicago Heights, with a branch line from Monticello to Logansport. S.

TOLEDO, OHIO.—An order was recently made by Judge Manton of the Toledo common pleas court, confirming the sale of the Toledo Urban & Interurban Electric railway, the Toledo & Findlay Railway Company. The road was sold last August to George Harvey for $400,000 and turned over to the reorganized company, which embraced the Toledo Urban & Interurban Electric Railway and the Toledo, Bowling Green & Southern. Suits which were filed to set aside the sale have been withdrawn.

SCOTTSBURG, IND.—The preliminary survey of the route between this city and Madison for the construction of a road by the Cincinnati, Madison & Western Traction Company, has been completed. Men interested in the enterprise from Pittsburg, Cincinnati & Madison went over the route last week and announced that the road will be built at once. They also decided to build a large terminal station in this city at a point where the new road will connect with the Indianapolis & Louisville line. S.

HARRISBURG, PA.—A charter application of the Phoenixville Valley Forge & Strafford Street Railway Company has been approved by Governor Stuart. The new line will be ten miles long, connecting Phoenixville with Strafford by way of Valley Forge. The capital is $60,000 and the incorporators are Thomas E. O'Connell, of West Chester, president; Senator O. E. Thomson, John A. Dismant, C. F. Boden, Samuel W. Deininger, A. W. Kley, H. H. Gilkyson, Jr., E. C. Meir and I. E. Miller, Phoenixville.

PEORIA, ILL.—Another interurban is being promoted from this city, this is the Joliet, Peoria and Galesburg, which is being promoted by H. H. Haines and is alleged to have the backing of J. P. Morgan interests. While in Rock Island the promoter who is the president of the Hampton Traction Company, operating several lines in the state of Pennsylvania, stated that his company considers Illinois a favorable state to build in. The line will be first built between Peoria, Joliet and Rock Island and later build to Galesburg. V.

DES MOINES, IA.—Articles of incorporation have been filed by the Iowa & Southwestern Railway Company, which proposes to build an interurban from Clarinda, in Page County, to Blanchard, Ia., by way of College Springs. The capital stock of the company is $300,000. The incorporators are: W. S. Farquhar, I. H. Taggart, Joseph A. McKinley, O. C. Wetmore, A. M. Abbott, J. M. Rumbaugh, J. N. Miller, A. F. Galloway, W. N. Dewhurst, John H. Walkinshaw, Ed F. Rose, G. William Richardson, C. M. Henn, V. Graff and T. E. Powers. The head offices of the company will be at Clarinda, Ia.

SAN FRANCISCO, CAL.—The Oregon Short Line Railway Company has completed the purchase of the San Francisco, Idaho & Montana railroad, in which Salt Lake capital was interested, and which was organized to build an electric line from Caldwell, Ida., south to Jordan Valley, Oregon, thence southwest via Duncan and south to Winnemucca. The contract which was awarded to D. M. Brogan of Vail, Ore., by the original promoters will be completed under the supervision of Oregon Short Line engineers. A new line which is being built along the Snake river will be extended by the Oregon Short Line to make connection with the line just purchased. This Snake River line was originally projected from Buhl to Nyssa.

SPARTA, WIS.—The construction of an interurban line between Sparta and Winona, Minn., via La Crosse, has been practically assured by the granting of a fifty-year franchise to the La Crosse Water Power Company by the La Crosse City Council. The electric road will be about fifty miles long and will cost about $3,000,000. Under the franchise granted at La Crosse, steam may not be used at any time as a motive power, the construction will be under the board of public works and the city engineer, not more than seven cars of freight may be hauled at one time, and several other restrictions are stipulated. It is stated that the power will be obtained from the Hatfield dams. W. J. Ferris is president of the company which will build the road. M.

## TELEPHONE AND TELEGRAPH.

*(Special Correspondence.)*

MARLIN, TEX.—The city has granted a franchise to the Independent Telephone Company. P.

MANDAN, N. D.—The North Dakota Independent Telephone Company has been incorporated with a capital of $50,000. P.

PARK RIVER, N. D.—The Park River Telephone Company has been incorporated with a capital stock of $20,000. P.

PAXTON, NEB.—The Paxton & Elsie Telephone Company has been incorporated with a capital stock of $5,000. P.

CAMP CROOK, S. D.—The Belle Fourche Rural Telephone Company is building a line down the Little Missouri River to Camp Crook. C.

WINONA, MINN.—The Northwestern Telephone Exchange Company is planning the installation of a new toll board in the exchange building. C.

NOONAN, N. D.—Henry J. Kotschevar, Rolf Reite and Albert H. Makee, all of Noonan, incorporated the Mutual Telephone Company; capital $15,000. C.

FAIRVIEW, PA.—The Fairview Independent Telephone Company has recently been incorporated by Job Morley. The company is capitalized at $10,000.

MARTIN, N. D.—A. H. Nikolaus, G. Kalk, Karl Schauer, all of Martin, have incorporated the Sheridan County Telephone Company, with a capital of $20,000. C.

RUGBY, N. D.—John Richey, Brazil, N. D., A. B. Fox, Brazil, N. D., and W. E. Fox, Rugby, N. D., incorporated the Western Telephone Association with a capital of $20,000.

WHITEFISH, MONT.—The Big Bend Light and Power Company will take charge of the local telephone system formerly owned by Carl Green. The central office will be moved, a 200-drop switchboard installed and a 200-pair cable put up. C.

NEWTON, IA.—The Jasper County Telephone Company has been merged with the Iowa company after several months of negotiation. A new switchboard to cost $15,000 will be installed.

INDIO, CAL.—The Corona Mutual Telephone and Telegraph Company has filed its articles of incorporation here. The incorporators are: J. B. Hooch, Andrew Lindberg and O. M. Grizzle of Corona. A.

PORT LAVACA, TEX.—The Port Lavaca Telephone Company has begun construction work on its twenty-five mile line to Port O'Connor. It is expected that the line will be in operation in a very short time.

KINGMAN, IND.—Articles of incorporation have been issued by the Secretary of State to the Kingman Telephone Company. The capital stock is $10,000 and the incorporators are C. L. Steinbaugh and J. W. Black.

TOLEDO, OHIO—The Lima Telephone Company has just taken over the Delphos Home Telephone plant at Delphos, O. D. J. Cable, president of the former company, announces that there will be changes in the management of the newly acquired concern. H.

VERMILION, O.—It is reported that the Vermilion Telephone Company, operating the independent exchange here, has consummated a deal whereby it will take over the Bell exchange and franchise. Long distance connections wilil be made with both the United States and Bell lines.

FOLSOMVILLE, IND.—The Folsomville Farmers' Mutual Telephone Company, has been incorporated; capital, $10,000. The company proposes to build, equip and operate a telephone exchange and system in Folsomville and throughout the surrounding communities, A. M. Fisner, Robert Perigo, P. D. Cannon, J. W. Roberts, Robert Skelton and W. N. Boyd are directors. S.

GUTHRIE, OKLA.—On complaint of telephone expert Player, the corporation commission cited ten local telephone companies at Ardmore, Atlus, Custer City, Billings, Weatherford, Hastings, Jennings, Kingfisher, Nowata and Marshall, to appear January 11 and show why they should not be fined for contempt for failure to submit additional data asked in connection with their reports.

INDIANAPOLIS, IND.—William Fortune, president of the Indianapolis Company and vice-president of the New Long-Distance Telephone Company, has made a statement to the effect that a controlling interest of these properties had been purchased by the Morgan syndicate of New York. Mr. Fortune states that the properties will continue independent and that the companies will pursue the same policies as in the past. He advises the people that the properties of both companies will be developed and extended during the coming year so as to almost double the present capacity and that excellent service will be given. Mr. Fortune says that the transfer will prove wonderfully advantageous to the Independent companies in Indiana and that nothing will be left undone for want of finance. S.

JACKSON, MISS.—The Mississippi Home Telephone Company is pushing work with all possible despatch on its long-distance lines into Jackson and it has been announced by officials that connections with Jackson will be made by January 1. One of these lines is between Jackson and Meridian and construction forces are now at work on it near Lake, Miss. A three-circuit system will be installed and an automatic switchboard will do away with a central-system. Toll stations will be established at all of the towns between Meridian and Jackson. The Mississippi Home Telephone Company also has a line in progress of construction between Jackson and Hattiesburg which will be completed by the time the corporation has its Jackson local exchange in readiness for service. B.

## ELECTRICAL SECURITIES.

The year-end requirements on the money market have had a somewhat restraining influence on the market during the past few weeks and although there have been many fluctuations, they were within rather narrow limits. Owing to the cases of the Standard Oil and American Tobacco companies, which are still pending in the Supreme Court, there is as yet considerable uncertainty which is detrimental to speculation and which it is feared may in some degree retard business activities. On the whole, however, prospects are very favorable, and still further increase in the values of securities may be expected.

The annual meeting of the Interborough-Metropolitan Company will be held on January 18 in New York City. Books closed December 24 and reopen January 18.

Chicago Railways rehabilitation expenditures on December 1 were $22,000,000. November earnings increased seventeen per cent, equaling the best previous month since the company was formed.

The Massachusetts Railroad Commissioners have approved the issue of Norfolk & Bristol Street Railway Company $50,000 twenty year five per cent equipment bonds.

The American Telephone and Telegraph Company has notified the Chicago Stock Exchange that capital stock of a par value of $255,284,000 is outstanding and convertible bonds not exchanged to amount of $4,735,000 outstanding.

The annual meeting of the stockholders of the Minneapolis General Electric Company will be held January 3.

Williams, McConnell & Coleman are offering the bonds of the Empire District Electric Company, which owns light and power companies in Missouri and Kansas. Estimates of earnings for 1911 show approximately four times interest requirements. The company has favorable franchises and operates in a developing territory.

Notwithstanding the fact that the law does not give the Texas State Railroad Commission jurisdiction of electric railways where they do not transport freight, that body has agreed to approve the bond issue of the Galveston-Houston Interurban Electric Railway Company in order to overcome any technicality that might stand in the way of the sale of the bonds.

At the annual meeting of the Massachusetts Electric Company it was voted to issue gold coupon notes to the amount of $5,000,000, payable at such time and at such rate of interest as the trustees may deem expedient. Of the proceeds, $3,500,000 will be used to retire a similar issue maturing January 1, 1910; the balance will be used for the general purposes of the companies. Trustees were re-elected.

Negotiations have been closed for the placing of a large block of Mahoning & Shenango Railway and Light first consolidated refunding mortgage five per cent bonds. The present issue, which amounts to $3,800,000 is being handled by Lee, Higginson & Company and Blair & Company, who are offering the unsold balance at ninety-seven and interest, yielding nearly five and five-eighths per cent. The bonds are redeemable at 105 and interest on any interest date, and constitute substantially a closed mortgage.

It is stated that the Chicago-Milwaukee Electric bondholders will take the road from the receivers in January and operate under new management. According to advices from Chicago, the net earnings in the last fiscal year were about $159,000, or over one per cent on the outstanding $15,000,000 of bonds. The $10,000,000 of Wisconsin Division bonds are held largely in Canada. The $5,000,000 of Illinois Division bonds were originally held in the Netherlands, but nearly all the Dutch holdings have recently been secured by Canadian and American interests.

N. W. Harris & Company, E. H. Rollins & Sons and Perry, Coffin & Burr have purchased $2,000,000 Southern California Edison Company general mortgage five per cent bonds, due November 1, 1939. This company owns and operates the electric and gas properties formerly owned by the Edison Electric Company of Los Angeles, serving in addition to Los Angeles, Pasadena, Redlands, Riverside and other cities, the total population served being approximately 600,000. The bonds will be offered for sale by the bankers in the near future.

### DIVIDENDS.

American Cities Railway and Light Company; one and one-half per cent on both common and preferred, payable January 1.

Boston & Worcester Electric Companies; $1 per share on preferred stock, payable January 1.

Chicago City Railway Company; quarterly dividend of one and one-half per cent, payable December 30.

Cincinnati Gas and Electric Company; quarterly dividend of one and three-sixteenths per cent, payable January 1.

Cincinnati Traction Company; quarterly dividend of one and one-half per cent, payable January 1.

Duluth Edison Electric Company; regular quarterly dividend of one and one-half per cent, payable January 1.

Massachusetts Lighting Companies; quarterly dividend of one and one-half per cent, and an extra dividend of one-quarter per cent, payable January 15.

Manila Electric Railroad and Lighting Corporation; one per cent on common stock, payable December 31.

Northwestern Elevated Railroad Company; quarterly preferred dividend of one per cent, payable January 18.

Otis Elevator Company; quarterly dividend of one and one-half per cent, payable January 15.

Reading Traction Company; a dividend of seventy-five cents per share, payable January 1 to stockholders of record December 14.

Tri-City Railway and Light Company; regular quarterly dividend of one and one-half per cent, payable January 3.

United States Light and Heating Company; semi-annual dividend of three and one-half per cent on preferred.

Westinghouse Electric and Manufacturing Company; quarterly dividend of one and three-quarter per cent on preferred, payable January 15.

NEW YORK.

| | Dec. 20. | Dec. 13. |
|---|---|---|
| Allis-Chalmers common | 15 | 15⅛ |
| Allis-Chalmers preferred | 54½ | 54 |
| Amalgamated Copper | 88 | 86⅞ |
| American Tel. & Cable | *80 | *80 |
| American Tel. & Tel. | 142 | 142⅞ |
| Brooklyn Rapid Transit | 80 | 80¼ |
| General Electric | 159¾ | 160¼ |
| Interborough-Metropolitan common | 24⅛ | 24½ |
| Interborough-Metropolitan preferred | 60½ | 61¾ |
| Kings County Electric | 129 | 129 |
| Mackay Companies (Postal Telegraph and Cables) common | 91 | 91¼ |
| Mackay Companies (Postal Telegraph and Cables) preferred | 77 | 76¼ |
| Manhattan Elevated | 139 | 140¼ |
| Metropolitan Street Railway | 20 | 20 |
| New York & New Jersey Telephone | 123½ | 123½ |
| U. S. Steel common | 92½ | 90⅞ |
| U. S. Steel preferred | 125¼ | 125½ |
| Western Union | 78⅛ | 77¾ |
| Westinghouse common | 82¼ | 84½ |
| Westinghouse preferred | 133 | 130 |

BOSTON.

| | Dec. 20. | Dec. 13. |
|---|---|---|
| American Tel. & Tel. | 142 | 142⅞ |
| Edison Elec. Illuminating | 249 | ... |
| General Electric | 159¾ | 160¼ |
| Massachusetts Electric common | 15½ | 15 |
| Massachusetts Electric preferred | 79 | 76 |
| New England Telephone | 137 | 135½ |
| Western Tel. & Tel. common | 12¾ | 12 |
| Western Tel. & Tel. preferred | 92 | 89½ |

PHILADELPHIA.

| | Dec. 20. | Dec. 13. |
|---|---|---|
| American Railways | 46½ | 45¼ |
| Electric Company of America | 12⅜ | 12¼ |
| Electric Storage Battery common | 56 | 57 |
| Electric Storage Battery preferred | 56 | 57 |
| Philadelphia Electric | 13½ | 13½ |
| Philadelphia Rapid Transit | 27½ | 28¼ |
| Philadelphia Traction | 89 | 88¾ |
| Union Traction | 52¾ | 52½ |

CHICAGO.

| | Dec. 20. | Dec. 13. |
|---|---|---|
| Chicago Railways, Series 1 | 103 | 95 |
| Chicago Railways, Series 2 | 32½ | 30½ |
| Chicago Subway | 4¾ | 4¾ |
| Chicago Telephone | 135 | 135½ |
| Commonwealth Edison | 118 | 117½ |
| Metropolitan Elevated common | 19 | 16½ |
| Metropolitan Elevated preferred | 58 | 53 |
| National Carbon common | 103 | 102½ |
| National Carbon preferred | 123 | 123 |

## PERSONAL MENTION.

H. SMITH of the Chicago General Electric Company has purchased an interest in the Monroe Electric Light and Power Company, and will attend personally to the management of the company.

V. J. DIEFENDERFER, formerly manager of the Birmingham office of the Allis-Chalmers Company, has resigned to accept a new position. Mr. Diefenderfer is at present with the Hardie-Tynes Manufacturing Company, of Birmingham, Ala., as the sales manager.

W. C. WEBSTER, who has for several years been New York manager of the Westinghouse Electric and Manufacturing Company, has recently resigned his position with that company. Mr. Webster formerly acted as vice-president of the Westinghouse company and has for some time been their New York representative.

O. S. MORE has resigned his position in the engineering department of the Western Electric Company. He will succeed B. F. Bailey, chief engineer of the Fairbanks-Morse Electrical Manufacturing Company, of Indianapolis, Ind., who has joined the faculty of the University of Michigan.

L. A. CROWELL, head of the lamp department of the Westinghouse Electric and Manufacturing Company, recently addressed the Consolidated Electric Lighting Company Association at Montpelier, Vt., on the subject of "Tungsten Lamps." Mr. Crowell gave an interesting and detailed account of the methods of lamp manufacture which are used by his company.

JOSEPH E. WAYNE, of Philadelphia, was recently appointed superintendent of the York Railways Company to succeed F. P. Newman, who has become General Manager of the Johnstown Traction Company, at Johnstown, Pa. Mr. Wayne was born in Philadelphia and is probably the youngest railway superintendent in the country. He spent three years with the New Jersey Public Service Corporation, drilling himself for the responsible position which he afterwards accepted with the United Railroads of San Francisco, California. After remaining there for three years he came to York and became general superintendent of the York Street Railway, afterward resigning to accept the position of superintendent of the Waynesboro, Chambersburg and Greencastle Street Railway.

## PROPOSALS.

POST OFFICE, MANCHESTER, N. H.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 13, 1910, for the construction (complete) of the extension to the United States Post Office and Court House at Manchester, N. H., in accordance with the drawings and specifications, copies of which may be had at the office of the custodian at Manchester, N. H., or at the Supervising Architect's office.

POST OFFICE, EMPORIA, KAN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 14, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Emporia, Kan., in accordance with the drawings and specifications, copies of which may be had from the Custodian at Emporia, Kan., or at the Supervising Architect's office.

POST OFFICE, HENDERSON, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 17, 1910, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Henderson, N. C., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Henderson, N. C., or at the Supervising Architect's office.

POST OFFICE, LA CROSSE, WIS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 19, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of an extension, remodeling, etc., to the United States Post Office and Court House at La Crosse, Wis., in accordance with drawings and specifications, copies of which may be obtained from the Custodian at La Crosse, Wis., or at the Supervising Architect's office.

## NEW PUBLICATIONS.

JOURNAL OF THE UNITED STATES ARTILLERY.—With Vol. 32, No. 3 (November-December, 1909) of this publication is issued a supplementary volume devoted to an "Index to Current Military Literature" which covers a big field of American and foreign journals and other publications. A large number of electrical entries are included. The regular issue of the Journal contains the usual variety of articles of special interest to artillery men, together with various abstracts and translations from contemporaneous technical literature under the head of "Professional Notes," among which are some articles of direct electrical interest.

UNIVERSITY OF ILLINOIS, MINING DEPARTMENT.—The department of mining engineering of the University of Illinois has recently issued a circular descriptive of the course of mining engineering lately established at the university. This circular can be obtained by applying to the registrar of the University, Urbana, Ill. The department of mining is especially fortunate in having located at the University of Illinois the first substation of the general testing station of the Technologic Branch of the United States Geological Survey. At this station mine bosses and others are trained in the use of oxygen helmets. The station is a great advantage to the students in mining engineering, as it brings them in contact with the men engaged in mining practice from all parts of Illinois and the surrounding states.

## NEW INCORPORATIONS.

CHICAGO, ILL.—The Reliable Electric Company has been incorporated to manufacture electrical supplies and equipment, with a capital of $30,000. The incorporators are: F. W. McNeal, O. C. Junge and G. W. Dodormer.

JERSEY CITY, N. J.—The American "Z" Electric Lamp Company has been incorporated to manufacture electric lamps. The capital is $1,000,000, and the incorporators are: H. Brunner, A. Romberg, Paris, France; B. Treacy, Jersey City.

CAMDEN, N. J.—The Automatic Street Railway Switch Company has been incorporated to manufacture automatic railway switches. The incorporators are: A. M. Haldeman, J. G. Ryan, C. Blake, of Philadelphia. The capital is $50,000.

ATLANTIC CITY, N. J.—The Cuthbert Transmission Syndicate, Incorporated, has been incorporated to manufacture power and speed transmission appliances. The capital is $75,000, and the incorporators are E. F. Hall, A. F. Hall and H. A. Locha, Atlantic City.

NEW YORK, N. Y.—The Friedrich Electric and Manufacturing Company has been incorporated to manufacture X-ray tubes, interrupters, etc., and to engage in electrical work. The capital stock is $60,000, and the incorporators are: J. J. Sullivan, H. E. von Pein and T. Faber, New York city.

NEW YORK, N. Y.—The S. K. F. Ball Bearing Company has been incorporated to do a mechanical and electrical engineering business, with a capital of $50,000. The incorporators are: S. T. Hubbard, Yonkers; F. H. Poor, Morristown, N. J.; A. Calander, Gothenburg, Sweden.

NEW HAVEN, CONN.—The New Haven Electric Manufacturing Company, of North Haven, has filed a certificate of incorporation in the office of the Secretary of State. The company is capitalized at $50,000, but will begin business with $5,000. The incorporators are John Frum of Cheshire, Harry C. Barber of Plainville, and Epaphroditus Peck of Bristol.

WHITE PLAINS, N. Y.—The Standard Connector Company has been incorporated with the Secretary of State, to make and sell electric connectors. The capital stock is placed at $30,000, consisting of shares of $100 each and the directors for the first year are Samuel L. Chamberlain, of New York city; Frederick J. Danks, of Brooklyn; Herbert C. Chamberlain, of Yonkers, and F. N. Brundage and C. S. Ashley, of Cranford, N. J.

## LEGAL NOTES.

JUDICIAL APPROVAL OF IMPORTANT NEW USE OF TELEPHONE—The use of the telephone in business has given rise to some new and interesting legal questions. Already there have been a number of cases in which conversations over the telephone have been held admissible in evidence. Another, apparently new, and very important question is the subject of decision in the recent case of Gilpin vs. Savage, 112 New York Supplement, 802, where the question was as to whether a presentment or demand for payment of a note, made over the telephone, was a sufficient presentation, and whether the bank was relieved of the obligation, under the facts, of actually going to the makers' house, where the note was payable, and making a further presentation and demand there. The Supreme Court of New York, trial term, Erie County, says that the researches of counsel and the court were unable to discover any decided case directly in point. But it seems to the court that all the essentials of a good presentation were met. The use of the modern invention of the telephone, the court says, is recognized by the courts. Commercial transactions and conversations had over the telephone have been recognized as of the same binding force as where the parties talked face to face. The telephone is simply an instrument by which two persons may talk directly to each other. Suppose the holder of a note should call to the maker from across a street, as the maker stood in his doorway, and notify him that he had his note and ask payment. Would not such a demand be deemed in law a proper presentment, although the street separated the person holding the note and the actual place of payment? Can it make any substantial difference because the person holding the note happens to be some blocks away, provided he is able to reach the maker over the telephone and talk directly to him in that way?

POWER OF MUNICIPALITY TO EXCLUDE TELEPHONE COMPANY FROM PARTICULAR STREET—The only question before the Supreme Court of Michigan in the case of Village of Jonesville vs. Southern Michigan Telephone Company, 118 Northwestern Reporter, 736, was, assuming that the council of said village had a right to impose such reasonable regulations as it saw fit, as a condition precedent to the entry of the defendant company, whether or not it could, as one of such reasonable regulations, absolutely prohibit the company from going upon a particular street. There was cited a decision in which it was stated that under the police power municipalities may prohibit the erection of poles in places, and in a manner which will injure or incommode the public. Does this power, so defined, confer upon the municipality the right to wholly exclude the poles and wires from a single block of a single street? The court thinks it does, unless it is made to appear that by the adoption of such a regulation the telephone company is cut off from communication with persons it desires to reach and whom by law it is obliged to serve. The complainant in this case urged that this one block was its main business block, and that to permit it to be incumbered with poles and wires would not only render it unsightly, but would appreciably increase the risk from fire by making it more difficult for the fire department to erect ladders and reach a conflagration. The mere fact that the route designated by the municipality was less convenient or involved on the part of the telephone company a larger expenditure was of no consequence so long as the company was not thereby prevented from reaching all those it desired to serve or who desired service from it. Where a municipality, in the exercise of its inherent police power, prescribes the manner, character or place of construction of a contemplated line, the telephone company must comply with such regulation and exercise its right of entry under the general powers conferred by the state subject to them.

RIGHT OF RAILROAD COMPANIES TO CONSTRUCT PARTNERSHIP TELEPHONE OR TELEGRAPH LINES ON QUALIFIED RIGHTS-OF-WAY—The St. Louis Court of Appeals says, in the case of the St. Louis, Iron Mountain & Southern Railway Company vs. Cape Girardeau Bell Telephone Company, 114 Southwestern Reporter, 586, that in Missouri the estate of a railroad company in land acquired for railroad purposes, right-of-way, etc., amounts to an easement only. The fee to lands thus occupied continues to reside in the adjacent landowners. But the telegraph and telephone are conveniences so essential, if not indispensable, to the purpose of a railroad, that a railroad company may establish and construct one or both along the line of its right-of-way to be used in the prosecution of its business in operating the road, and such use, essential as it is, is not an additional servitude upon the fee. In other words, such conveniences essential to the prosecution of the calling for which the railroad right-of-way was acquired are within the contemplation of the original grant for railroad purposes, and therefore regarded as not an additional servitude upon the fee of the adjacent landowner. Authorities to this effect are numerous and sound in principle. The railroad company therefore may construct and maintain such telephone or telegraph line on the right-of-way for its own purpose, or it may contract with another to erect and maintain the line and furnish the required service to the end of transmitting intelligence with respect to the operation of its trains and other needs of its calling. In such circumstances the telephone is not an additional servitude upon the fee of the adjacent owner, but is viewed as a legitimate development of the easement acquired for railroad purposes. Nevertheless, in so far as the telegraph or telephone company thus rightfully occupying the right-of-way serves the general public as a commercial enterprise, distinct from the avocation of the railroad, it constitutes a use of the right-of-way easement other than for railroad purposes, and it is therefore a servitude not contemplated in the original grant and a burden upon the fee of which the adjacent owner may rightfully complain. But another railroad company, which likewise has but an easement to use the adjoining land for railroad purposes, cannot, as an abutter, complain of such commercial use of the telephone for the reason that its easement for railroad purposes only is in no way impaired or infringed thereby.

## INDUSTRIAL ITEMS.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, Ill., is distributing a booklet describing and illustrating automatic traffic distributors in connection with manual telephone equipment.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing a unique and attractive folder containing an article relative to the business policy of the Buckeye Company and giving convincing reasons why Buckeye lamps should be used.

THE ECONOMY DRAWING TABLE COMPANY, Toledo, Ohio, is distributing a catalogue devoted to drawing tables, sectional filing cases, and other furniture of this nature. It contains illustrations and descriptions of various drawing tables, engineers' desks, drawing files, etc.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has recently distributed the December number of its publication entitled "Paistery." This issue contains illustrated descriptions of sign receptacles, sockets, pull sockets, wooden panel boxes, panel cut outs for rotary snap switches in addition to the customary interesting editorials.

THE STEEL CITY ELECTRICAL COMPANY, 1207-19 Washington Avenue, Pittsburg, Pa., has recently distributed a folder describing and illustrating Star bushings. These bushings, according to the circular, are made of malleable iron, are rust-proof, have wide finger grips and are accurately threaded. They are shipped in boxes containing 100 each.

THE ROCK ISLAND BATTERY COMPANY, Cincinnati, O., has recently sent out a catalogue devoted to Rock Island Dry cells. The publication contains descriptions and illustrations of the various types of cells dealing fully with "Sparker" special cells for use on automobiles. The catalogue contains a description of the Rock Island battery ammeter ranging from zero to thirty amperes.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., has secured a contract to equip a mining plant at Parral, Mex., and will install the following electrical machinery: Three 250-kilowatt, 480-volt engine type alternators and one 500-kilowatt alernator, with switchboards and exciters. The equipment is to be furnished by the Allis-Chalmers Company, also of Milwaukee.

THE BATTERY COMPANY, Milwaukee, Wis., has recently distributed Bulletin No. 1, which gives descriptions and prices of battery lighting plants using the Gugler primary battery lighting system. This system is a new method of generating electrical energy, as adopted to electric lighting, which has been reduced to commercial practice. The bulletin illustrates applications of this system for both lighting and power purposes; gives views of the equipment supplied with each system and other interesting data in connection with the subject.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is sending out an attractive folder, No. 434, describing and listing its line of stamped steel knockout boxes known as Multilets. As the name implies, one box is intended for many uses. Multilets are made in two sizes with a set of covers for each size. Multilets can thus be used for any necessary combination with rigid conduit, Greenfield flexible steel conduit or BX conductors. They accommodate standard fittings and do not require special fittings for special work.

THE AMERICAN GAS AND ELECTRIC COMPANY, of Atlantic City, N. J., has selected Babcock & Wilcox boilers for its new power house. Each of the four 500-horsepower boilers is to be equipped with a six-retort Taylor gravity underfeed stoker.

THE H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., has recently appointed H. H. Seaman, assistant manager of its New York electrical department. For seven years, Mr. Seaman was associated with the Electric Storage Battery Company at Philadelphia, Detroit and Cleveland, and for the past two years, has been manager of their Atlanta office.

THE PHOENIX GLASS COMPANY, Pittsburg, Pa., has recently sent out Catalogue C describing the new Pheno system of illumination with tungsten lamps. This system consists of a line of carefully designed, scientifically correct illuminating devices. These devices known as Pheno Reflectors are claimed to have perfect diffusion combined with strong reflecting qualities. This catalogue also describes and illustrates the Deep Tungsten Holder to be used in connection with Pheno reflectors.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing Bulletin No. 89 which describes type BW polyphase induction motors. These motors combine wound rotor starting characteristics, high starting torque, minimum starting current, squirrel cage operating characteristics and simplicity of control. They are suitable for practically all installations in which squirrel cage motors can be used and this bulletin contains several views of the application of them. It also contains curves and diagrams of general interest.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, O., announces the removal of its office and factory to (Oakley) Cincinnati, O., where greatly increased facilities enable it to satisfactorily meet the requirements of its customers. It also announces that it has purchased the foundry of the Model Foundry Company and with the added facilities obtained expect to produce even better work than heretofore. This company is also distributing two interesting booklets devoted to isolated lighting plants and electricity in a modern bakery respectively.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has sent out the December issue of "Trumbull Cheer," its regular monthly publication. It contains several interesting Christmas stories, some good editorials and in addition an illustrated description of the improvements and changes made in Trumbull switches during the past few months. This company is also sending out a Christmas token in the form of a Lincoln penny and offers fifty dollars in prizes for those who, according to a competent corps of judges make the best use of this penny.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing three new circulars descriptive of condulets and their application. A number of illustrations show the method of employing condulets in connection with pole type transformers, interior lighting, etc. This company is also distributing a circular descriptive of its type A meter connecting blocks, intended for use in installing and testing induction type service meters, and a circular devoted to a description to alphaduct flexible conduit. Particular attention is called to the fact that this conduit is flexible, moisture proof and will withstand any climatic changes.

THE EXCELLO ARC LAMP COMPANY, New York and Chicago, has recently distributed a booklet entitled "Modern Business Street Lighting." This publication contains a brief history of the arc lamp and describes the extent to which the flaming arc lamp is used in Europe. It contains curves showing the distribution of light from Excello Flaming arc lamps and also a comprehensive table comparing the expenses incurred in maintaining one Excello lamp and three enclosed arc lamps. Curves showing the comparison of expenses and the comparison of illumination are also reproduced. The booklet also calls attention to a reproduction of a photograph of a Chicago business street illuminated by Excello flaming arc lamps.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., manufacturers of woven wire dynamo brushes, composite brushes and wire specialties, has recently sent out a catalogue and price list devoted to these products. There have been many changes in the use of dynamo brushes but for low voltage use Crown brushes have been extensively used. These brushes have also been extensively used on machines used in the manufacture of electro-chemical products. Also a very large demand has been created in the automobile industry for Crown brushes for use on magneto igniters. All of these types of brushes are described and illustrated in the catalogue. The company announces that large quantities of its brushes are being shipped to Canada, England, Germany and other foreign countries.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., announces that its San Francisco office has been moved from 599 Mission Street to the Byron Jackson Building, 160 Second Street, corner Natoma Street, in order to accommodate its increased selling force. The territory is in charge of R. B. Elder, who has been engaged in engineering on the Pacific Coast for the past fourteen years. An attractive office has been provided with greatly increased facilities for the handling of the company's products, and with the advantages of a warehouse containing a complete assortment of small machinery such as breakers, motors, transformers, repair parts, etc., prompt and satisfactory service is assured. The large West Allis Works and other plants of the company are equipped to ship to the Coast on short notice, any type of prime mover, including steam turbines, gas engines and hydraulic turbines, electrical machinery of all kinds, mining, crushing and cement machinery, saw mill, flour mill and power transmitting machinery.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued Bulletin No. 4702 showing the various advantages to be gained by the use of the Horizontal Curtis Steam Turbine in connection with the pumping equipment of fire boats. This turbine is especially adapted to such work since it operates most efficiently at the high peripheral speed necessary to obtain the maximum output with centrifugal pumps. Two pamphlets are also being sent out which should be of special interest to owners of either electric or gasoline automobiles. The one illustrates and describes the method of charging electric automobiles from alternating-current circuits by means of the General Electric rectifiers, the other shows the advantage of the use of not only electric light in connection with gasoline cars, but the use of the tungsten lamp to produce this light. The pamphlet contains a wiring diagram which will be of assistance to one contemplating the wiring of his machine. The number of these pamphlets are 3878 and 3874 respectively. Bulletin No. 4708, just issued by the same company, describes in more or less detail an instrument recently placed upon the market by them for use in the testing of wattmeters. The meter here described possesses all the requirements for rapid and accurate testing. It is portable and is inclosed in a neat wooden case which is provided with a leather handle.

### DATES AHEAD.

South Dakota State Independent Telephone Association, Hudson, South Dakota, Jan. 11-13, 1910.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

# RECORD OF ELECTRICAL PATENTS.

**Issued (United States Patent Office) December 14, 1909.**

942,885. METHOD OF AND APPARATUS FOR REPEATING TELEPHONE-CURRENTS. Percy A. Campbell, Bloomfield, N. J. Filed July 20, 1909. A series of condensers are charged in turn from an incoming circuit, the plates of the charged condensers are mechanically separated in turn, and the condensers are finally discharged in turn in an outgoing circuit.

942,894. ELECTRIC HEATER. Robert Farren and Charles T. Clark, Cleveland, Ohio. Filed December 3, 1908. An electric water-heating device comprises a chamber having in it an arrangement of circulating pipes associated with the heating elements.

942,897. APPARATUS FOR RECEIVING SUBMARINE SOUNDS. Thomas A. Garrett, Reigate, and William Lucas, Crouch End, England. Filed August 31, 1909. Variations in the magnetism of a rod (connected at one end to the side of a vessel and carrying a mass at the other end) are detected by a telephone receiver, etc.

942,901. APPARATUS FOR ELECTRICALLY IGNITING GAS-BURNERS. Alfred J. Hill, Woodford Green, and Frederick C. D. Mann, Hayes, England. Filed January 4, 1909. Utilizes a spark gap and high-tension current.

942,911. SPEED-CHANGING MECHANISM. Emil E. Keller, Pittsburg, Pa. Filed November 14, 1905. A torque-controlled mechanism is dependent upon the operation of a number of

independently operative electrically controlled clutches which separately transmit power.

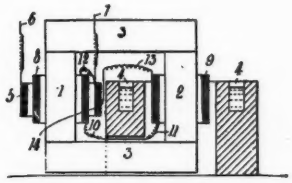
942,936. TIMING AND IGNITION DEVICE. William H. Saunders, New London, Conn. Filed August 31, 1908. Describes the make-and-break device and its connections associated with the spark plug of an internal-combustion engine.

942,960. STARTING-SWITCH FOR ELECTRIC MOTORS. Edmund Garside, Darlington, England, assignor to Engineering Instruments Limited, Darlington, England. Filed September 8, 1909. A contact on a carriage fixed to the piston of a dashpot engages with the resistance terminals. The carriage may be connected at will to the operating switch arm.

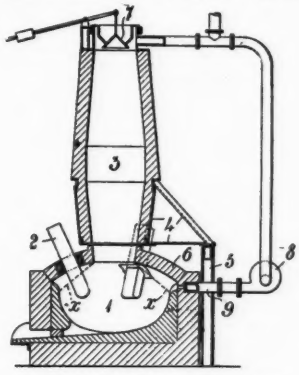
942,961. TRANSFORMER-FURNACE. Eugen A. A. Grönwall, Axel R. Lindblad, and Otto Stålhane, Ludvika, Sweden. Filed May 2, 1907. Coils placed in the path of the leaking lines of force are devised so that the magnetomotive force generated by the coils will counteract the leaking lines of force from the primary coil of the furnace.

942,964. ELECTRIC-LIGHTING ATTACHMENT FOR BURGLAR-ALARM SYSTEMS. Maximilian F. Juruick, New York, N. Y., assignor to Electric Bank Protection Company. Filed August 16, 1907. One automatic drop operates an alarm and another the switch of a lighting circuit.

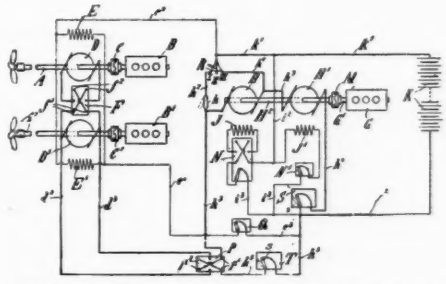
942,968. SAFETY DEVICE FOR ELEVATORS. John A. Miller, Baltimore, Md., assignor to John M. Thurston, trustee, Washington, D. C. Filed March 5, 1907. Renewed August 14, 1909. A normally closed safety circuit includes a series of door switches and a solenoid the core of which carries a latching detent to engage with a catch notch on a lock wheel mounted on the elevator shaft.



942,961.—TRANSFORMER-FURNACE.



943,224.—ELECTRIC FURNACE.



943,434.—SHIP'S SCREW-DRIVING MECHANISM FOR SUBMARINE BOATS.

942,981. ELECTRIC CONTROLLER. Clarence L. Taylor, Alliance, Ohio, assignor to The Morgan Engineering Company, Alliance, Ohio. Filed March 6, 1909. Resistance elements are sustained by the arms of a series of conducting bars supported in the frame.

942,990. STORAGE-BATTERY TANK. Theodore A. Willard, Cleveland, Ohio. Filed May 14, 1907. Between the outer casing of wood and the internal lining of lead are interposed layers of protective material of relatively high and low melting points.

943,011. CONTROL SYSTEM FOR ELECTRIC MOTORS. Arthur C. Eastwood, Cleveland, Ohio. Filed May 24, 1909. The fields for two or more armatures (arranged in parallel) are arranged in series with each other and with one only of the armatures.

943,016. ELECTRIC SWITCH. Monroe Guett, Hartford, Conn., assignor to The Hart & Hegeman Manufacturing Company, Hartford, Conn. Filed February 7, 1906. The faceplate has separate apertures in alinement with the contacts; there is a pair of shutter plates under the surface of the plate and movable transversely of these apertures, etc.

943,033. TELEPHONE-RECEIVER SUPPORT. William J. Mogridge, Spokane, Wash. Filed September 28, 1908. Describes an arrangement of clamp and supporting arm, etc. ,for a telephone receiver.

943,066. ALLOY FOR ELECTRICAL RESISTANCE. Wilbur B. Driver, East Orange, N. J. Filed April 6, 1906. Gives proportions for various nickel-manganese alloys.

943,078. MEANS FOR LOCKING ELECTRIC SOCKETS TO FIXTURES. Harvey Hubbell, Bridgeport, Conn. Filed September 4, 1909. Describes an arrangement of a flanged cap and bushings, etc.

943,081. TELEPHONE-CALL-REGISTERING SYSTEM. Willard J. Kibbe, Canandaigua, N. Y. Filed April 22, 1908. An electromagnetically operated call-registering device is connected to the answering and calling switchboard cords.

943,115. SELECTIVE SIGNALING APPARATUS. Oscar M. Leich, Rochester, N. Y., assignor of one-third to J. G. Ihmsen and one-third to Max W. Zabel, Chicago, Ill. Filed February 3, 1905. A selective signaling apparatus is associated with an electric circuit, with which is also associated an electrically nontuned signaling apparatus having a bridge impedance device causing it to operate on a frequency other than that which operates the first-named apparatus and to be nonresponsive to currents adapted to operate this apparatus.

943,134. POST OR TELEGRAPH AND TELEPHONE POLE. Herbert E. Atchison, Ogden, Utah, assignor to The American Post and Pole Company. Filed April 10, 1908. A bar has angularly disposed sides and flukes projecting upward from its lower extremity, in a plane with the vertex of the angle.

943,149. MOUTHPIECE FOR TELEPHONE-TRANSMITTERS. John A. Jameison, Harrison, N. J. Filed June 8, 1909. Has a trumpet member secured by a kind of gooseneck device to the transmitter.

943,155. ELECTRIC MOTOR. Louden A. McCoubrie and Charles F. Raydure, Philadelphia, Pa. Filed April 29, 1909. Has special kind of brush-holders.

943,166. ELECTRIC CONTROLLING APPARATUS. William Schwagermann, Yonkers, N. Y., assignor to Ward Leonard Electric Company. Filed July 31, 1907. A reversing rheostat for a motor has two armature-controlling independently movable elements controlling the direction of rotation of the motor armature, and two no-voltage protective windings connected in a closed circuit containing a field winding of the motor.

943,174. CARRIAGE FOR ELECTRIC LAMPS. Robert S. Beard, Warwick, N. Y., assignor of one-half to L. A. Riley, 2d, Warwick, N. Y. Filed April 26, 1909. The carriage runs on two wireways.

943,187. ELECTROLYTIC WATER-PURIFYING APPARATUS. Harry B. Hartman, Pittsburg, Pa., assignor to McDowell Manufacturing Company, Pittsburg, Pa. Filed March 2, 1908. Periodically reserved current flows through vertical electrodes.

943,188. METHOD OF PURIFYING WATER ELECTROLYTICALLY. Harry B. Hartman, Pittsburg, Pa., assignor to McDowell Manufacturing Company, Pittsburg, Pa. Filed March 2, 1908. Similar to the preceding, but the flows of liquid and current are synchronously interrupted.

943,190. ELECTRIC CHAIN-LINK-WELDING APPARATUS. Carlton L. Hoff, York, Pa., assignor to Standard Chain Company, York, Pa. Filed December 5, 1907. Welding jaws movable toward and away from each other have between them a guide for positioning the link to be heated and removable from it when the heating is taking place.

943,196. ELECTRIC-RAILWAY SYSTEM. George H. Maire, Seattle, Wash. Filed November 29, 1907. Means operated by a car open and close a switch for connecting a normally open feed section with the line circuit.

943,215. ELECTRIC SWITCH. Henry J. Carrigan and Arthur J. Sangster, Buffalo, N. Y., assignors to Auto Safety Specialty Company. Filed September 22, 1908. Two rotatable contact arms engage independently with fixed contacts.

943,224. ELECTRIC FURNACE. Eugen A. A. Grönwall, Axel R. Lindblad, and Otto Stålhane, Ludvika, Sweden. Filed July 28, 1909. The electric furnace comprises a heating chamber, and stack communicating therewith (the chamber being organized to provide a free space between the charge and the top of the heating chamber when the charge is introduced into the chamber and into the lower portion of the stack), electrodes arranged to enter through the top wall of the heating chamber and extended down into the heating chamber to pass through the free space with their lower ends immersed in the charge, and means for introducing gas into the free space portion of the furnace.

943,246. ELECTRICALLY-ILLUMINATED SIGN. John H. Goehst,

Chicago, Ill., assignor to Federal Electric Company, Chicago, Ill. Filed June 11, 1909. The sign is carried by a bracket arm which has lamps placed suitably for illuminating the sign.

943,272. ELECTRIC TEMPERING-FURNACE. Vernon Roye and Vernon E. Royle, Paterson, N. J. Filed May 12, 1908. The tools to be tempered are automatically passed one after another into and out of an endless receptacle for fusible salts. Electric current is applied to the receptacle.

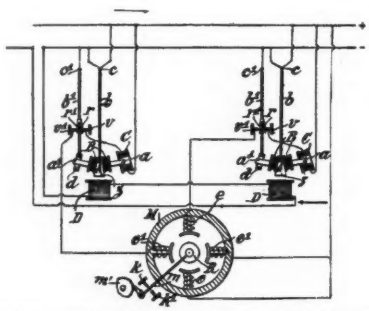
942,273. ELECTRIC-LIGHT SOCKET. Ralph A. Schoenberg, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Filed February 20, 1909. The bared ends of the feed wires may be located and removably held in apertures and grooves adjacent to the contacts carried by the lamp.

943,275. BATTERY-ELEMENT SUPPORT. Charles B. Schoenmehl, Waterbury, Conn. Filed April 1, 1909. Two or more transverse channel strips are mounted on a pair of guide wires, and a sheet-metal spring is arranged beneath the lower channel strips to hold the plate intermediately between the strips.

943,281. ELECTRICAL CONTACT DEVICE. James M. Smith, Philadelphia, Pa., assignor of one-half to Wilson D. Craig Wright, Philadelphia, Pa. Filed January 13, 1909. Has a stationary and a revolving element.

943,287. CONDUIT-CAP FOR ELECTRIC INSTALLATION. Wheeler H. Vibber, New London, Conn., assignor of one-half to The Gillette-Vibber Company, New London, Conn. Filed May 10, 1909. The frame has a hub extension on one side and arms for the insulators, etc., on the other.

943,290. ELECTRIC FURNACE. Charles E. Wilson, Hood River, Ore. Filed February 1, 1909. A stationary electrode extends downward into the furnace, and the other electrode is carried by the base. The furnace has removable sides and means for raising and lowering it.



943,531.—PENDULUM ELECTRICITY-METER.

943,305. ILLUMINATED TELEPHONE-DIAL. Rufus B. Hallock, Portland, Ore. Filed February 18, 1909. Describes illumination details for an automatic-telephone dial.

943,324. SPARKING DEVICE FOR GAS OR OIL ENGINES. Waldemar M. Stempel, Urbana, Ill. Filed March 1, 1909. The spark points of the spark plug are electromagnetically put into and out of contact with each other.

943,345. STORAGE BATTERY. Louis H. Flanders, Wilkinsburg, Pa., assignor, by mesne assignments, to Westinghouse Storage Battery Company. Filed February 23, 1905. A separator comprises a sort of latticework of two superimposed series of diagonally crossing strips.

943,352. ELECRICALY-OPERATED RAILWAY-CROSSING GATE. Thomas Hummel, Dallas, Tex. Filed March 6, 1909. Is actuated by means of a solenoid device.

943,368. BURGLAR-ALARM SCREEN. Peter Orance, Newark, N. J. Filed August 4, 1908. Contacts are made when any of several wires under tension is broken.

943,383. APPARATUS FOR FIRING EXPLOSIVES IN WELLS. Luke H. Broadwater, Findlay, Ohio, assignor to The E. I. du Pont de Nemours Powder Company, Wilmington, Del. Filed December 30, 1908. Renewed November 3, 1909. An electric device, in circuit with the firing wires, controls the action of the cutters.

943,384. ELECTRIC HEATER. Roy W. Brown, Amsterdam, N. Y. Filed October 22, 1908. A helicoidal heater is imbedded in a reinforced cement body.

943,386. SANITARY TELEPHONE-TRANSMITTER. Marvin Y. Calcutt, Seattle, Wash. Filed April 12, 1909. An auxiliary diaphragm is secured to the transmitter casing, and a cleaning pad carried by the cover may be brought into contact with the diaphragm.

943,403. MELTING-HEARTH FOR ELECTRIC INDUCTION-FURNACES. Carl Grunwald, Bredeney, Germany. Filed May 7, 1909. The trough is of a shape admitting of inspection of and access to the entire surface of the bars in the trough through serving openings.

943,434. SHIP'S-SCREW-DRIVING MECHANISM FOR SUBMARINE BOATS. Wilhelm Maier, Stuttgart, Germany, assignor to Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden, Germany. Filed August 15, 1908. Comprises a driving engine and an electric motor for each shaft; means adapting the engine and motor to act separately or together upon the propeller shaft; an auxiliary power plant consisting of two generators connected in series and an engine for driving the same; an electric accumulator for exciting the fields of all the aforesaid electric machines; a circuit through which the accumulator can be made to drive the first-mentioned motors; another circuit through which the accumulator can be made to drive one of the generators as a motor; and a switch for closing and opening the circuits.

943,438. MANUFACTURE OF RAIL-BONDS. George A. Mead, Mansfield, Ohio. Filed November 2, 1906. The bond is compressed after welding.

943,440. ALARM APPARATUS. Frank P. Moyer, Utica, N. Y. Filed January 22, 1909. Diaphragms covered with a catalytic substance co-operate with an electric alarm as for detecting gas.

943,483. ELECTRICALLY-HEATED TOOL. George E. Stevens, Lynn, Mass., assignor to General Electric Company. Filed August 4, 1908. The current is automatically switched on when the tool handle is grasped.

943,503. DYNAMO-ELECTRIC MACHINE. John B. Wiard, Lynn, Mass., assignor to General Electric Company. Filed December 6, 1905. The armature core has a special construction which is described in detail.

943,509. ELECTRICAL CABLEWAY SYSTEM. Otto Adam, Dresden, Germany. Filed April 20, 1908. A compensating generator is driven by the straining-rope operating element of the motor, and energizes a compensating winding in the motor circuit.

943,531. PENDULUM ELECTRICITY-METER. Charles Féry, Paris, France. Filed January 12, 1909. The meter comprises two frictionless electric pendulums having metallic connections at their points of suspension only, an auxiliary pendulum to each of these pendulums, mechanism whereby the auxiliary pendulum is oscillated by the main pendulum without contact therewith, contacts adapted to be closed by the auxiliary pendulum during its oscillations, and mechanism whereby the oscillations of the main pendulum are maintained owing to current traversing the contacts.

## PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 20, 1909:

488,179. TROLLEY STAND FOR ELECTRIC CARS. Edward M. Bentley, Boston, Mass.

488,198. ELECTRICAL DISTRIBUTION BOX. Wm. H. Hart, Brooklyn, N. Y.

488,222. INCANDESCENT ELECTRIC LAMP BASE. Frederick C. Rockwell, Hartford, Conn.

488,225. RAILWAY SIGNAL. Edmund Shaefer, Lynchburg, Va.

488,233. STORAGE BATTERY. Geo. A. Washburn, Cleveland, Ohio.

488,261. DYNAMO REGULATOR. Chas. J. Bogue, New York, N. Y.

488,285. SIGNAL REPEATER. Thomas H. Patenall, Rahway, N J.

488,298. DEVICE FOR RAISING OR LOWERING SUSPENDED ELECTRIC LIGHTS. Franklin P. Welsh, Omaha, Neb.

488,305. ELECTRIC MOTOR. Chas. S. Bradley, Yonkers, N. Y.

488,306. ALTERNATING-CURRENT MOTOR. Chas. S. Bradley, Avon, N. Y.

488,307. SYSTEM OF DISTRIBUTION FOR POLYPHASE ALTERNATING CURRENTS. Chas. S. Bradley, Avon, N. Y.

488,329. ELECTRIC ARC LAMP. Albert De Puydt, Liege, Belgium.

488,351. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Leon O. Dion, Natick, Mass.

488,367. TELEPHONE. Parnell Rabbidge, Sydney, New South Wales.

488,385. GUARD FOR TELEPHONES. Edward B. Chase, Philadelphia, Pa.

488,466. ELECTRIC FORGE. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,467. ELECTRIC METAL-HEATING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,468. ELECTRIC METAL-WORKING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,469. ELECTRIC METAL-HEATING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,502. TELEPHONE SYSTEM. Chas. C. Jennings, Chicago, Ill.

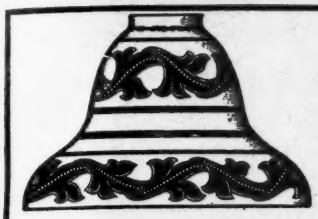
488,520. ELECTRICALLY-OPERATED STRINGED MUSICAL INSTRUMENT. Willard H. Gillman, Boston, Mass.

488,532. ELECTRICAL SWITCHBOARD. James W. Lyon, Brooklyn, N. Y.

# ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

VOL. LV, No. 1. CHICAGO, SATURDAY, JULY 3, 1909. THREE DOLLARS A YEAR Single Copies Ten Cents





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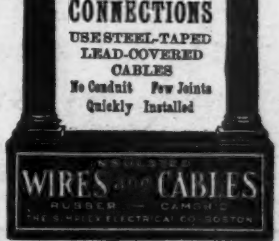




INDEX TO ADVERTISERS, PAGE 52. CLASSIFIED INDEX, PAGE 54.

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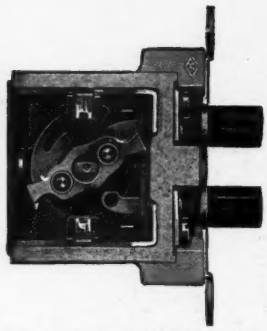

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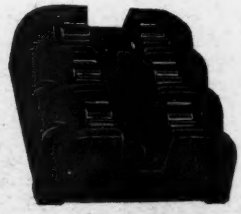

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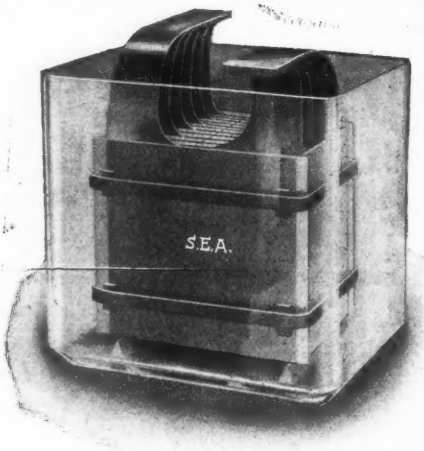


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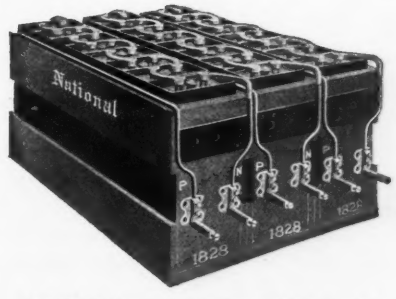


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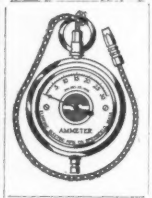

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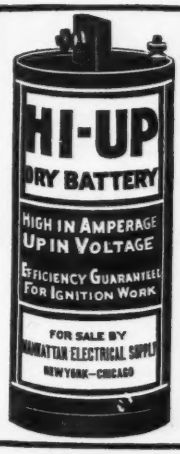


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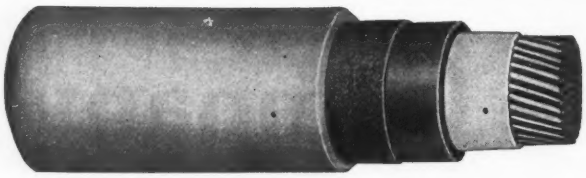

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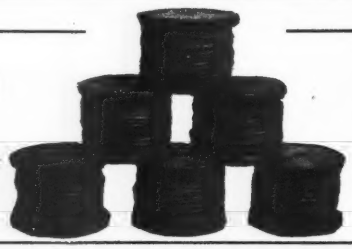

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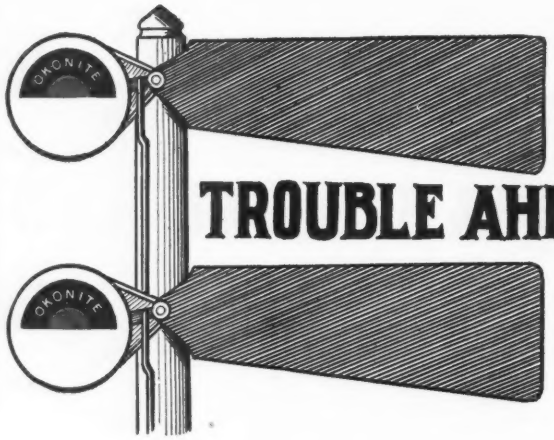


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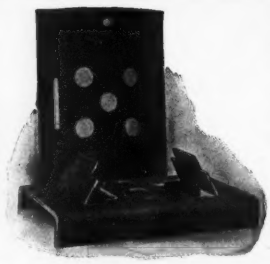

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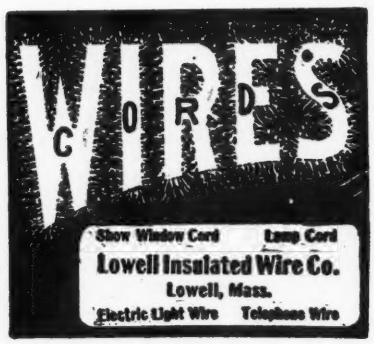




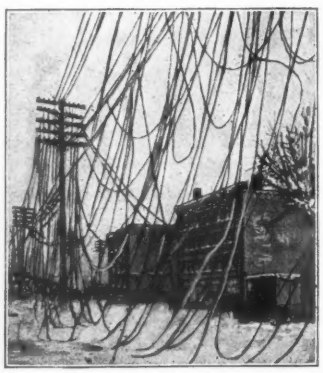

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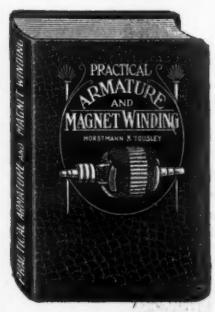


While the subject of armature winding has, in the past, been more or less completely covered, most of these works have been either too technical in their composition or have required a fair degree of knowledge of the subject before they could be clearly understood. There has been need for a book covering this matter which, while giving all that is necessary for an intelligent understanding, will, at the same time, present the matter in such a simple form that it can be readily grasped by those who have not had the benefit of a previous education along this line.

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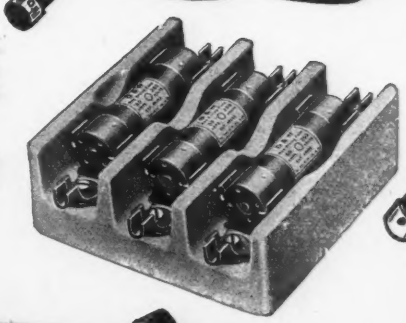

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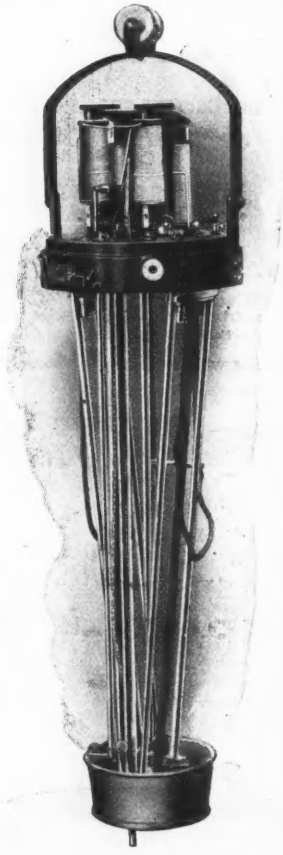

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As you can purchase this type and other standard ratings of Tungsten lamps from us on your regular contract discounts, we urge you to give them a trial. If you do, the conclusion is foregone — you will buy "Westinghouse" Tungstens only hereafter.

The feature of the 25-Watt Westinghouse Tungsten Lamp is in the method by which the filament is anchored. The delicate, accurately gauged tension applied in supporting the filament has resulted in reducing breakage and early burnouts to a negligible per cent.

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BUFFALO LINEMAN'S TOOL

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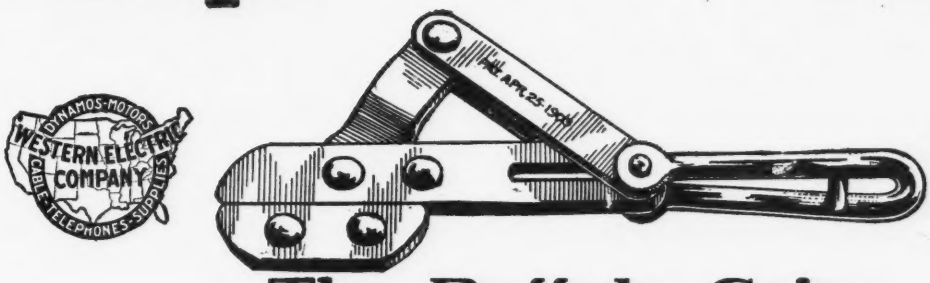


## The Buffalo Grip

is a construction tool that meets the user's needs exactly. It never slips, does not injure the softest wire, is simple in construction and operation, moderate in price and practically indestructible.

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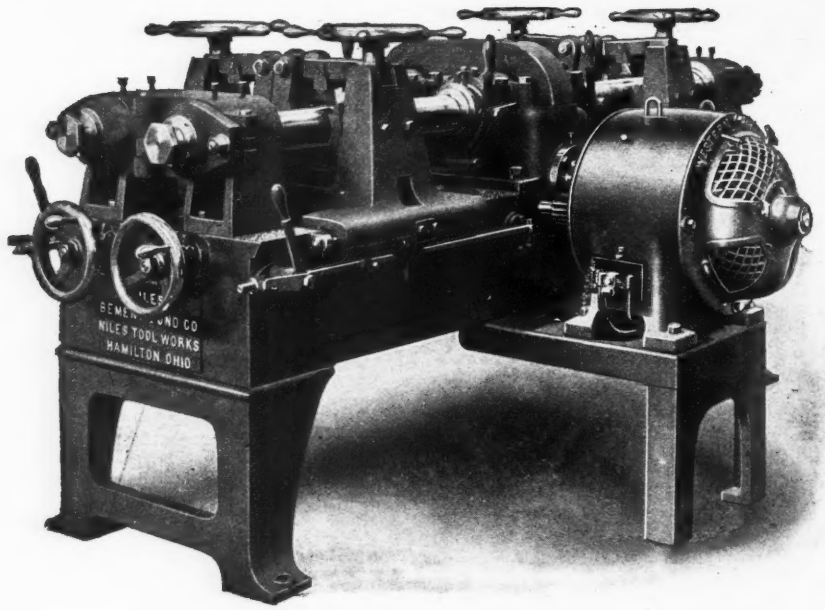


**Hawthorn Direct Current Motor
Driving Car Box Borer in Railroad Shop**

# Work All Your Machines At Their Maximum Capacity

By using the proper working speed for every operation, you can get maximum efficiency from all your machines.

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# Direct Current Motors

are especially designed for work requiring speed variations. The exact speed for any particular operation can be quickly reached and held constant with minimum attention from the operator. More work and better work are direct results. Let us tell you more about Hawthorn Direct Current Motors. We guarantee their performance.

***Free Bulletin No. 305 on Direct Current Motors is both interesting and instructive. Send for it to-day.***

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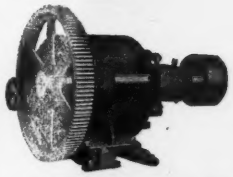
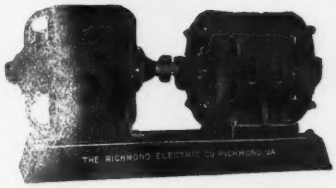
# RICHMOND
## Induction Motors

¼ to 100 H.P.

CONSTANT AND VARIABLE SPEED



BACK GEARED AND VERTICAL TYPES



MOTOR GENERATOR SETS

Alternators 1½ to 75 K.V.A.

The Richmond Electric Company,
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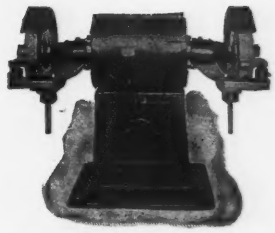

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GRINDERS = MOTORS
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Manufacturing Company, St. Louis, Mo.

## POLYPHASE MOTORS

### RUGGEDNESS

Compared with other polyphase motors manufactured in this country, Wagner Motors are in a class by themselves. Liberality of design and robust construction characterize them throughout. At a given rating they will be found from 50% to 100% heavier than anything else the market affords.

### THIS POLICY OF LIBERALITY

in design and ratings is responsible in part for the pre-eminent position occupied by the Wagner Company in the alternating-current motor business.

We invite opportunity to go into details with users and prospective users of polyphase motors.

Wagner, Quality

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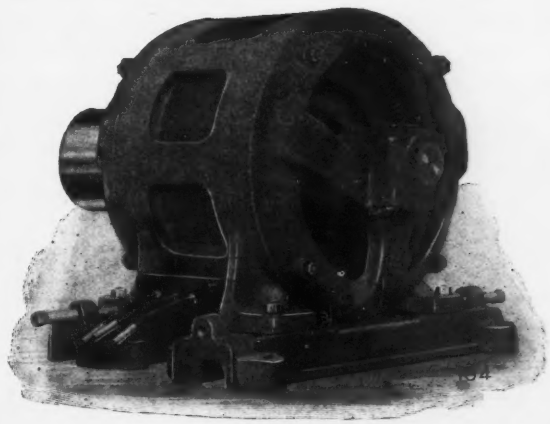
# C-W Induction Motors



*15 to 250 H. P. Induction Motor*

are built by a company that has made good since 1888. See Bulletin 105 K.

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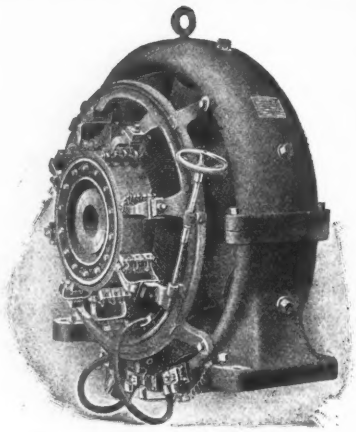

ENGINE-TYPE GENERATOR
Sizes to 350 K. W

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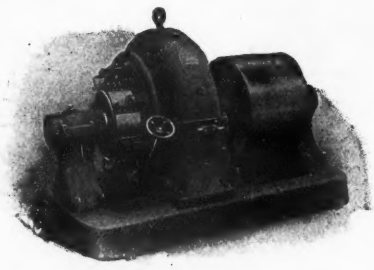

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Sizes to 500 H. P.

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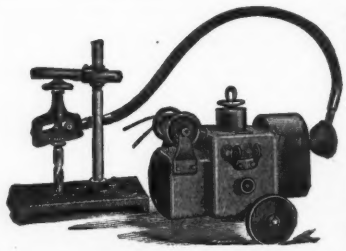

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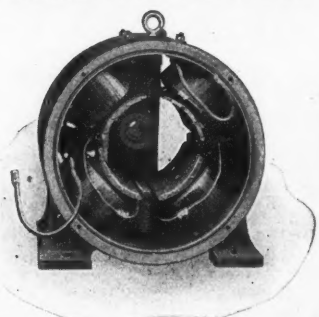

SPARKLESS COMMUTATION at all LOADS

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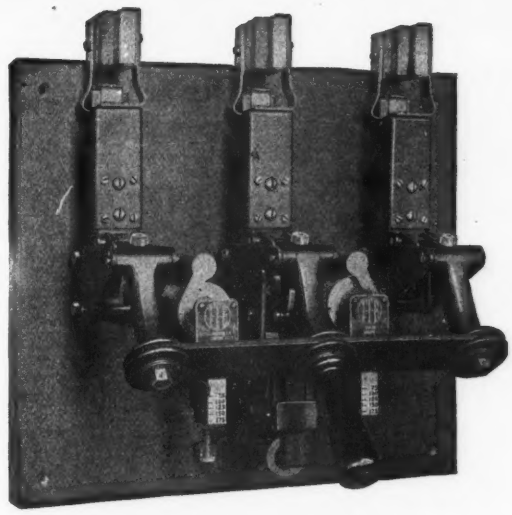
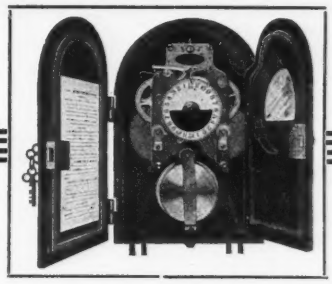


Three-pole, Type "W" Circuit-breaker, overload and voltage, designed for the protection of polyphase motors. Can also be supplied with "DAL-ITE" (Time Limit) feature.

## The Cutter Co.

**Philadelphia** (4)



S. and D. P. to 50 Amp.
T. P. to 35 Amp.
Types B, C, D, etc.

For All Voltages from 110 to 2,000

## The Hartford Time Switch

The most practical and efficient of all devices for the control and regulation of current on power or lighting circuits.

## Wind It Once a Week, That's All

Absolutely dependable. Regulates the current supply, giving you light or power where you want it, when you want it. Turns the current on or off at any predetermined hour, eliminating waste, reducing maintenance expense. Definitely guaranteed.

Write for details and prices.

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## Engine Type Alternators—Form D

Type TRE, Form D, Three-Phase Alternator

These alternators are designed for moderately slow speed operation and are equally well adapted for direct drive by steam, gas, gasoline or oil engines. Their liberal design and correct proportions, providing the most efficient use of all material, have shown in actual service such pleasing results that are not surpassed by any other machine. Their operation is entirely satisfactory in all instances.

**Our Bulletin 1109B describes these machines**

**Any of our Sales Offices will be pleased to supply you**

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817

# The Third Annual New York Electrical Show

MADISON SQUARE GARDEN
OCTOBER 11-21ST

will consist largely of industrial exhibits which will show the public in a practical way the many advantages of using electricity.

Madison Square Garden will be decorated elaborately and the booths, including a sign, will be provided by the Show Company, which will save exhibitors trouble and expense.

This year the cost of space includes everything except the handling of your own exhibits.

Central Station men will receive season passes

Write to
THE
THIRD ANNUAL
NEW YORK
ELECTRICAL SHOW
124 W 42d Street
New York

Franklin "got next" through a kite.

# CUT IN AND BE A LIVE ONE!

## "GET NEXT"

**Come to Toledo, Ohio, July 21, 22 and 23, fly a kite, get in touch with the National Electrical Contractors' Association and learn the key to success through intelligent organization and personal contact with the men who are doing big things for a big business.**

**The ninth annual convention of the National Electrical Contractors' Association is to be held in Toledo, Ohio, July 21, 22, 23.**

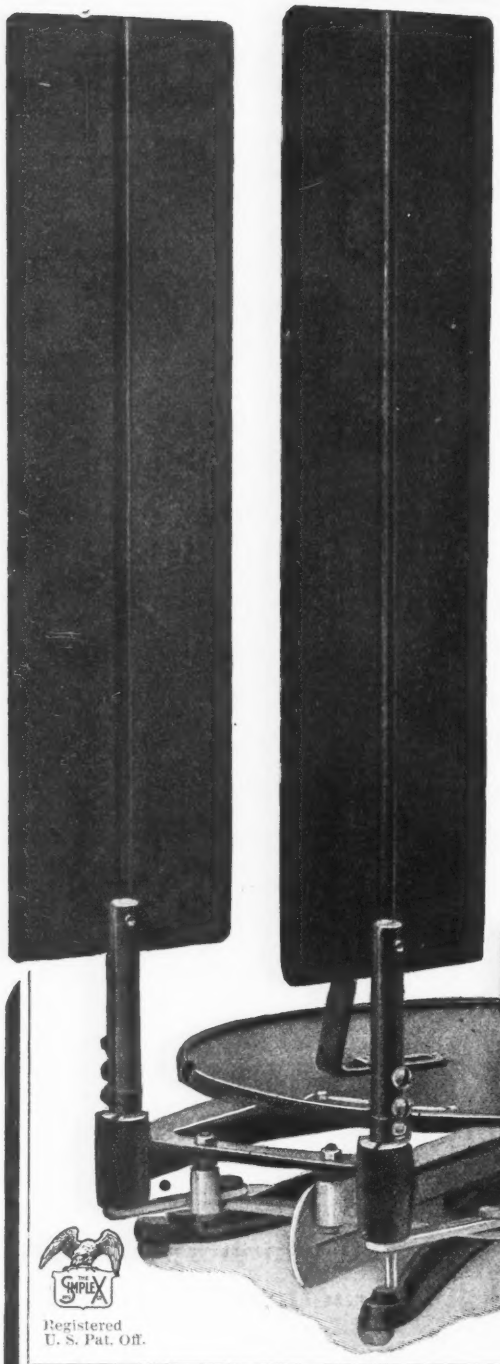
**All Electrical Contractors, whether members of the association or not, are invited to attend all meetings.**

**There will be open sessions at 10 a. m., July 21-22, at which speakers from other branches of the electrical industry will give practical talks that are sure to prove interesting and instructive, and all interested in the industry are welcome.**

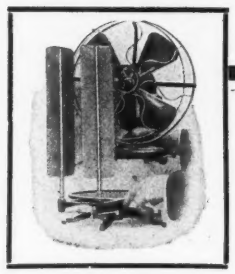
**On July 23 nobody'll work, even father, for they'll all take a day off and go on a boat excursion to Sugar Island, for an all-day outing. There will be field sports and a baseball game between teams from the East and West.**

**There will be a banquet for the men and another for the women on July 22.**

**Headquarters will be at the Boody House. Complete information can be secured by application to the National Secretary at Utica, N. Y.**



# A Campaign Base



in the Battle for More Business, is offered the enterprising dealer and the up-to-date Central Station man in the

## SIMPLEX OSCILLATING BASE

It sells "Juice." It makes new fans more salable and gives new life to dead fans.

**Mr. Central Station Man:** Are you producing a surplus? Are there gaps in your log? Those are the things that help mightily to put the balance on the wrong side of the ledger.

Let us help you to put that balance on the right side by turning that surplus into money. We can fill that gap. A sufficient number of electric fans in operation in your territory would do wonders. There are lots of dead ones—why not restore them to service and current-selling usefulness! Make every stationary fan an oscillating fan and sell "Juice."

Live dealers everywhere are stocking up with the Simplex Oscillating Base and placing them without difficulty. Get in line before the season's output is exhausted.

*Write for our Special Proposition.*

**The Simplex Mfg. Co.**

**West Street Bldg. New York**
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**BY J. R. CRAVATH and V. R. LANSINGH**

This book, dealing with the lighting of interiors by artificial means, supplies much of the needed specific data for carrying out in practice the principles that should be followed in the design of this work. Most of the information presented is of such a nature as to be valuable for the technical man, and read and applied with profit by the general public as well.

The apparatus for the production of light is not taken up, but the utilization to the best advantage of the light when produced is treated very thoroughly. Many tables of reliable and unbiased tests giving information on the light distribution of various illuminants with different globes, shades and reflectors are here published for the first time, so as to be available to the engineer. A large part of the book is given largely to illustrations of various lighting arrangements, with discussions of their desirable and undesirable features. The method of treatment throughout the book has been to illustrate principles, first by specific practical examples and then from these to point general conclusions.

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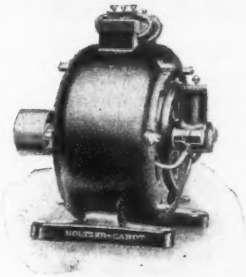
## Alternating-Current Motors



**⅛ to 2 Horsepower, Single-Phase, Induction Type, Self-Starting, Strong Torque.**

We make a specialty of small motors adaptable to varied classes of work.

Inquire for Bulletin 30Z4.

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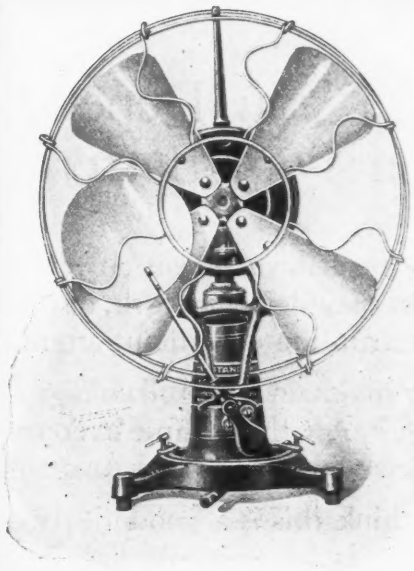

The Oscillator—D. C. and A. C.

## Cooling Breezes

are now a commercial commodity of exceptional selling quality. The live dealer who takes advantage of the universal demand for Electric Fans will find these sweltering days the most profitable of the year. For the Central-Station man the fan means elimination of the big midsummer gap in his log—the Electric Fan is now the liveliest of all current-selling devices.

Our "Standard" Fans enjoy the highest reputation and are well known through popular magazine and other advertising on a national scale.

Our line is complete, including every advanced type of Electric Fan for A.-C. and D.-C. currents—Oscillating, Desk, Bracket, Ceiling and Exhaust, all backed by our guarantee as to workmanship and material.

Complete stocks are in all our branches. We help you by prompt deliveries. The weather man will help, too. Catalogue and price lists on request. Send us a rush order.

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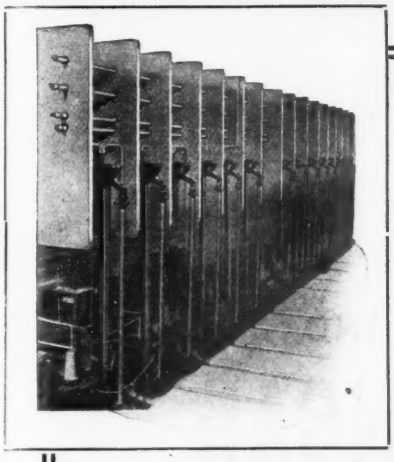

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CONDIT, the circuit-breaker man, will save you repair and renewal expenses and give you quality service.

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### Can You Depend Upon Your Batteries?

Do they furnish sufficient current for your needs? Do they do their work, day after day, without interruption or without attention?

Do they maintain their full voltage throughout their life? Are they simple in construction, easy to renew and economical to maintain?

If you think this is a good deal to expect of batteries, it is because you have never used

### Edison Primary Batteries

If you will tell us the purpose for which you wish batteries, we will advise you as to what type of Edison cells to get, how many and their cost. You will get from this equipment just the current you need for a guaranteed period of time.

Edison batteries maintain their full voltage from first to last, giving you the benefit of all the current they produce. When the elements are exhausted, they can be renewed at a small cost and each renewal makes new batteries of them.

Their economy will be evident in a few months' use. Their reliability will be evident from the start.

We gladly answer all inquiries on the subject of batteries for all purposes.

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# GOOD METERS

that is, meters which will measure electrical energy accurately when new, and which will also hold up well in service, are the rule nowadays; but when it comes to a ***good meter*** suitable ***for every service,*** with slight detail modifications in the several types, there is only one, and its name is

# SANGAMO

Sangamo meters are built as ***Integrating Wattmeters*** for both ***Direct*** and ***Alternating Current,*** as ***Ampere-Hour Meters for Direct Current,*** and in ***Service*** and ***Switchboard*** types, being suitable, therefore, for house service, for switchboard work, for street-railway cars, for electric locomotives, for use with large electroplating operations, and with storage batteries in central stations, on electric vehicles, on electric-lighted railroad cars, and in telephone exchanges.

If you are interested in any or all of these varied uses, send right away for latest bulletins:

***No. 12—A. C. and D. C. Wattmeters.***
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**SANGAMO ELECTRIC COMPANY**
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LAFAYETTE, IND.

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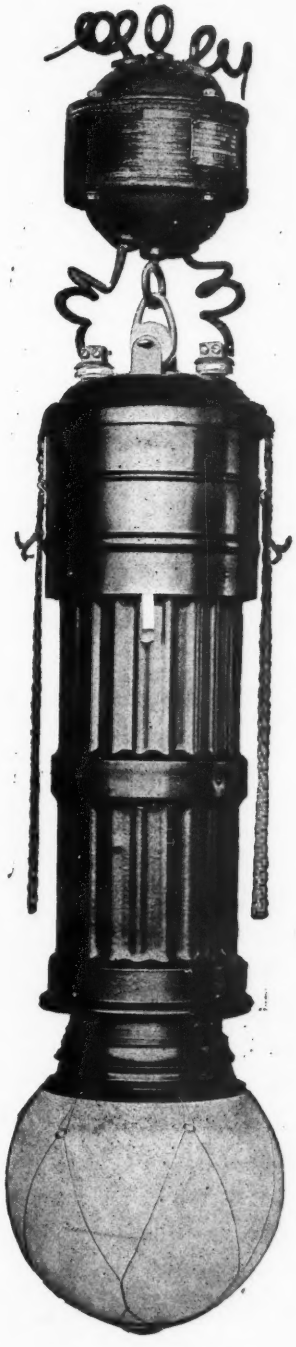

17-Hour G-I Flame Arc Lamp

## G-I Flame Lamps

The increasing demand of the public for more brilliantly illuminated business streets may satisfactorily be supplied by installing G-I Flame Arc Lamps.

The G-I Series AC Flame Lamp may be operated on the same circuit as the Series AC enclosed lamp. No changes in the circuit are necessary. The series AC flame lamp operates from the AC circuit through a compensator, or series transformer designed especially for this purpose. The compensator is neat in appearance, weatherproof, and designed for installing directly above the lamp. The lamps are absolutely steady and reliable in operation.

G-I Flame Lamps may also be furnished to operate on 9.6 amp., D. C. series circuits.

G-I Flame Lamps can be furnished for any commercial circuit, either alternating or direct-current, any frequency from 25 to 140 cycles, and they may be operated singly or in series. Ninety per cent of the parts are interchangeable. This feature makes the lamps economical for Central Stations handling both A. C. and D. C. types. To change an A. C. lamp to D. C., or vice versa, requires only new shunt magnets, one carbon holder, one carbon shifter.

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NEW YORK, 13 Park Row LONDON, E. C., 42 Old Broad St.

# The Electrical Contractor—

## A Good Man to Have on YOUR Books, Mr. Manufacturer

When it comes to interesting the consuming public—the people who use a manufactured article—it's a good thing to know the man who is right close to the people's jobs. The electrical contractor is one of the most important elements in the chain between the maker and user of electrical apparatus. He has the greatest influence with the architect, the builder and the owner. He is a good man to have on your books. He will be out in force at the annual convention of the

## National Electrical Contractors' Association

### TOLEDO, OHIO, JULY 21-23

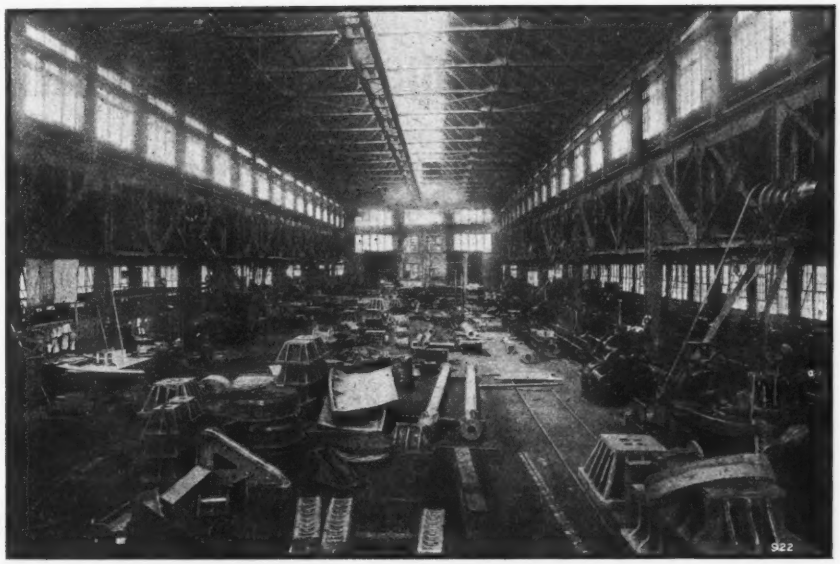
and he will represent an enormous purchasing power. Do you want to meet him? Do you want him to know you are alive, and after his business? Then send in your copy and instructions for advertising in the issue of the **ELECTRICAL REVIEW AND WESTERN ELECTRICIAN** of ***July 17,*** which will be prepared for extra distribution at this convention. Forms close July 14.

The ***July 31st*** Number of the **ELECTRICAL REVIEW AND WESTERN ELECTRICIAN** will contain reports of this convention. Forms close July 26.

It is the purpose of the publishers to put copies of these two numbers in the hands of every **ELECTRICAL CONTRACTOR** in the United States.

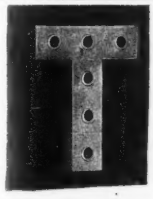
ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, 507 Marquette Bldg., Chicago
NEW YORK, 13 Park Row LONDON, E. C., 42 Old Broad St.

# American Bridge Company of New York



Interior of Machine Shop. Ambridge Plant.

**General Offices: Hudson Terminal, 30 Church Street, New York**



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Bulletin No. 27.

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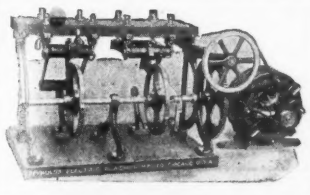

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(2)

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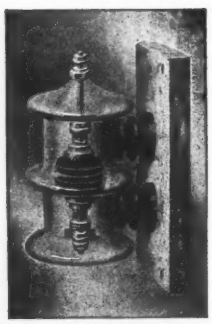

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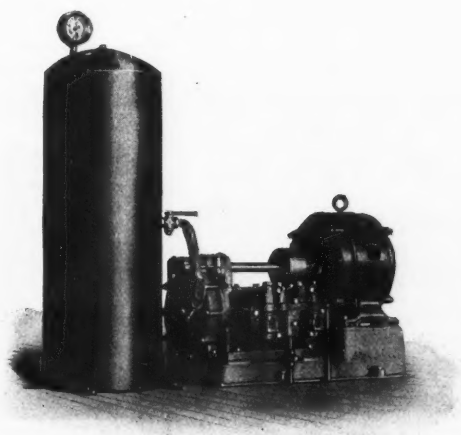

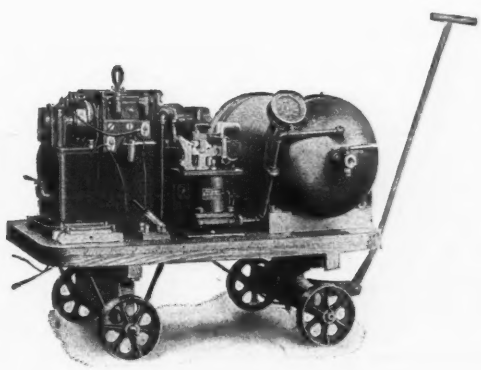

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DRY BATTERIES

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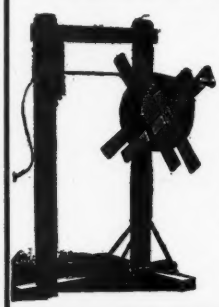

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| 1 | 6 | Amer. Eng. Co., MP | 550 |
| 3 | 7½ | Northern, MP | 1500 |
| 1 | 7½ | Aaron, MP | 750 |
| 1 | 7½ | Card, MP | 775 |
| 1 | 7½ | Roth, MP | 880 |
| 1 | 7½ | Commercial, MP | 540 |
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| 3 | 10 | Northern, MP | 800 |
| 1 | 13 | Burke, MP | 650 |
| 1 | 15 | Northern, MP | 1200 |
| 1 | 15 | Roth, MP | 775 |
| 1 | 15 | Northern, MP | 725 |
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| 1 | 15 | Milwaukee, MP | 700 |
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| 2 | 15 | Crocker-Wheeler, MP | 800 |
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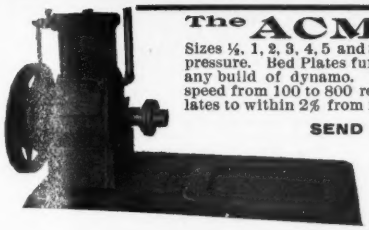

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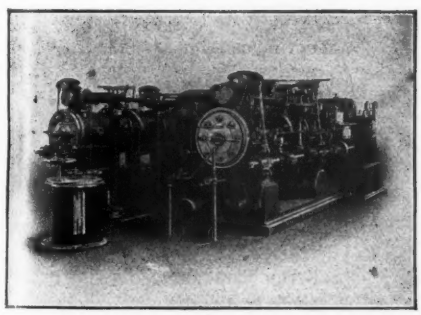

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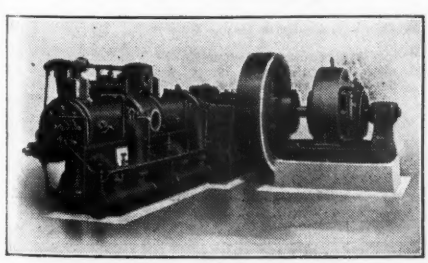

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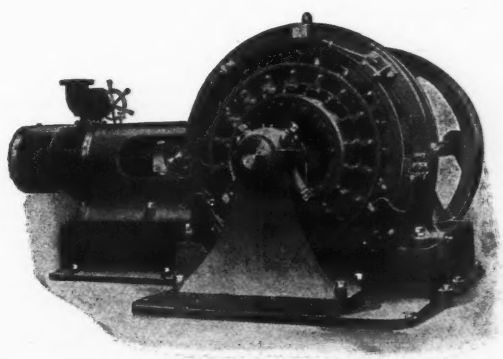

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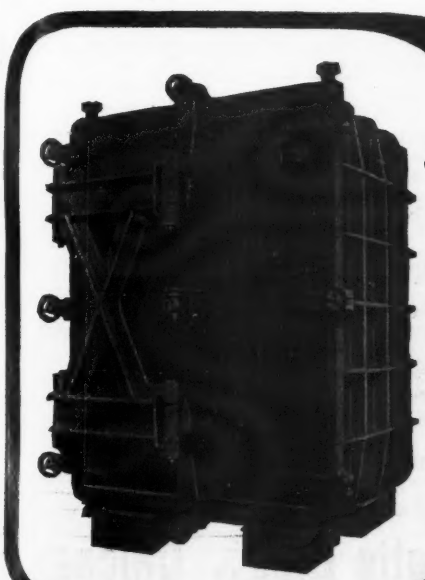

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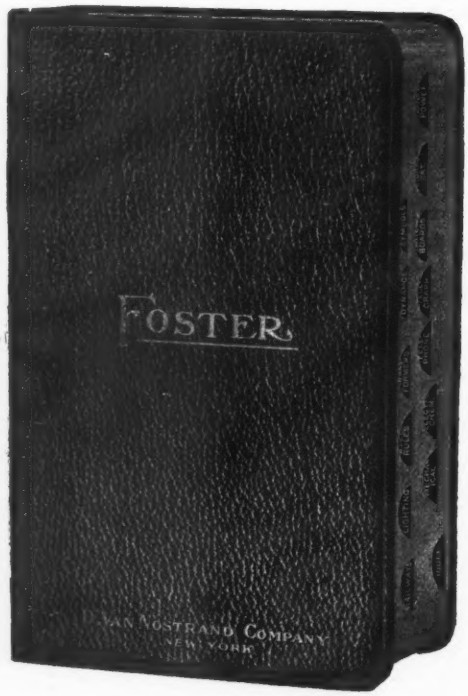


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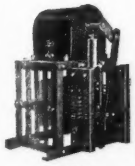

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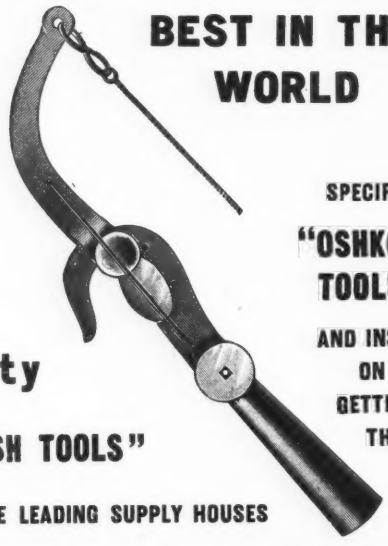

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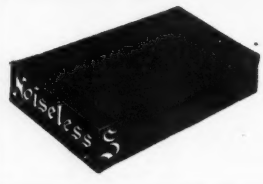


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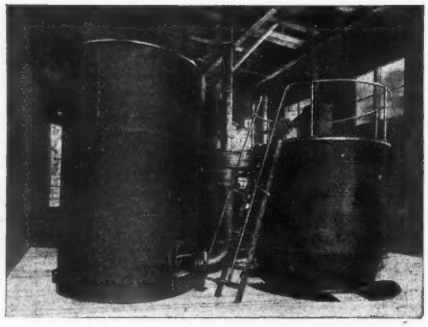

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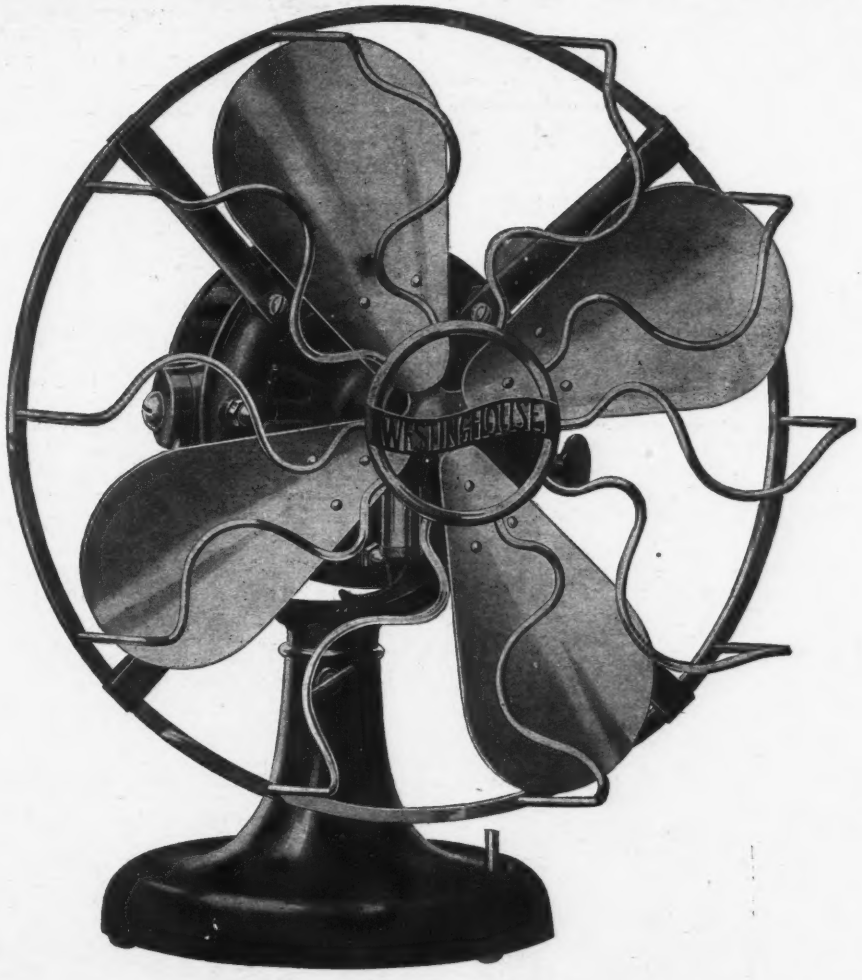


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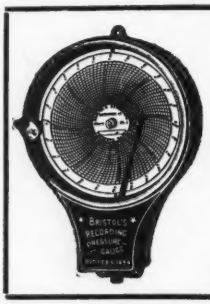

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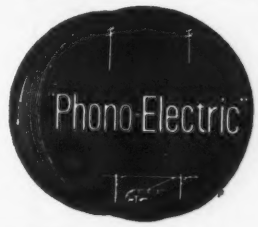


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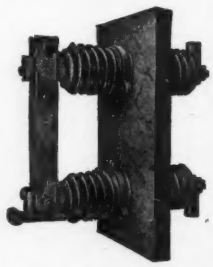

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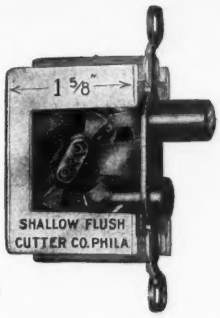


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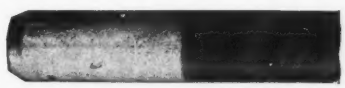

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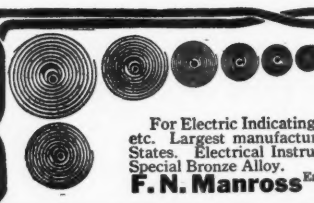

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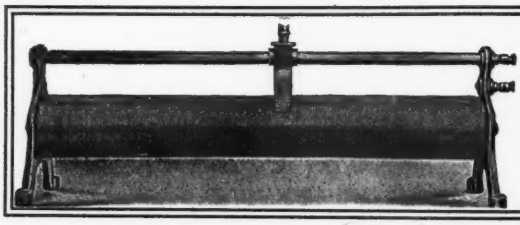

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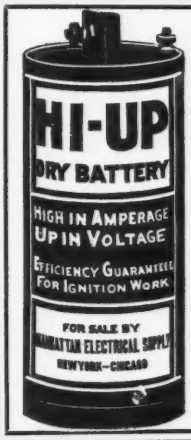


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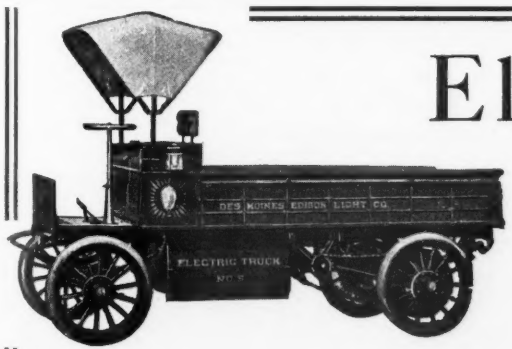
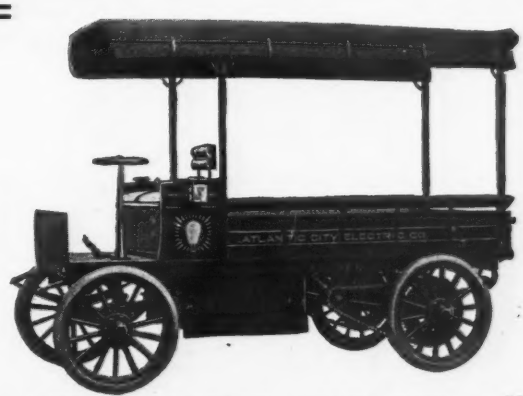


# Electric Vehicles AND THE TRANSPORTATION PROBLEMS



The demands of the trade presented the problems.

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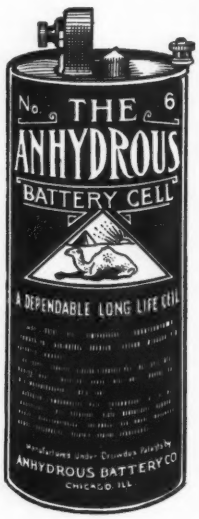


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For ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
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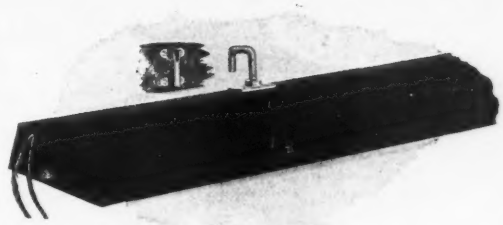
This new LINOLITE WINDOW REFLECTOR is designed especially for the illumination of Show Windows where the light must come from the top; or for the illumination of any space which is at a long distance from the source of light, and where it is desired to confine the greater part of the light to a small angle. The reflector proper is made of highly polished corrugated aluminum, covered with a metal protecting shell mounted on detachable hinged supports.



Type B—Window Reflector

Linolite Lamp

The highest efficiency is secured by the use of this system, by virtue of the perfect control and distribution of light.

It costs less to install LINOLITE than bulb lamps, and less to operate, because fewer lamps are required for the same result.

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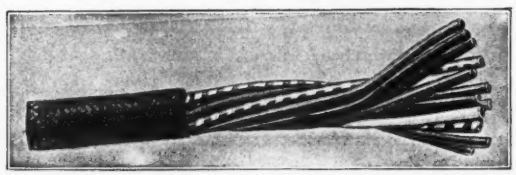

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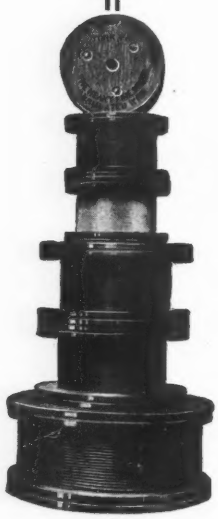

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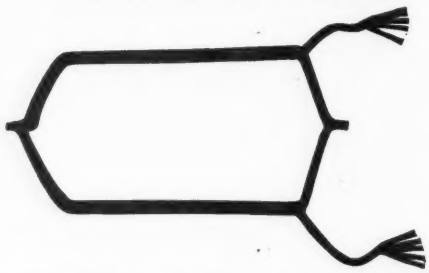

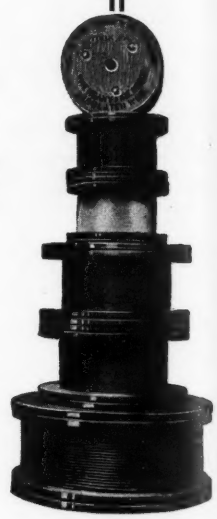

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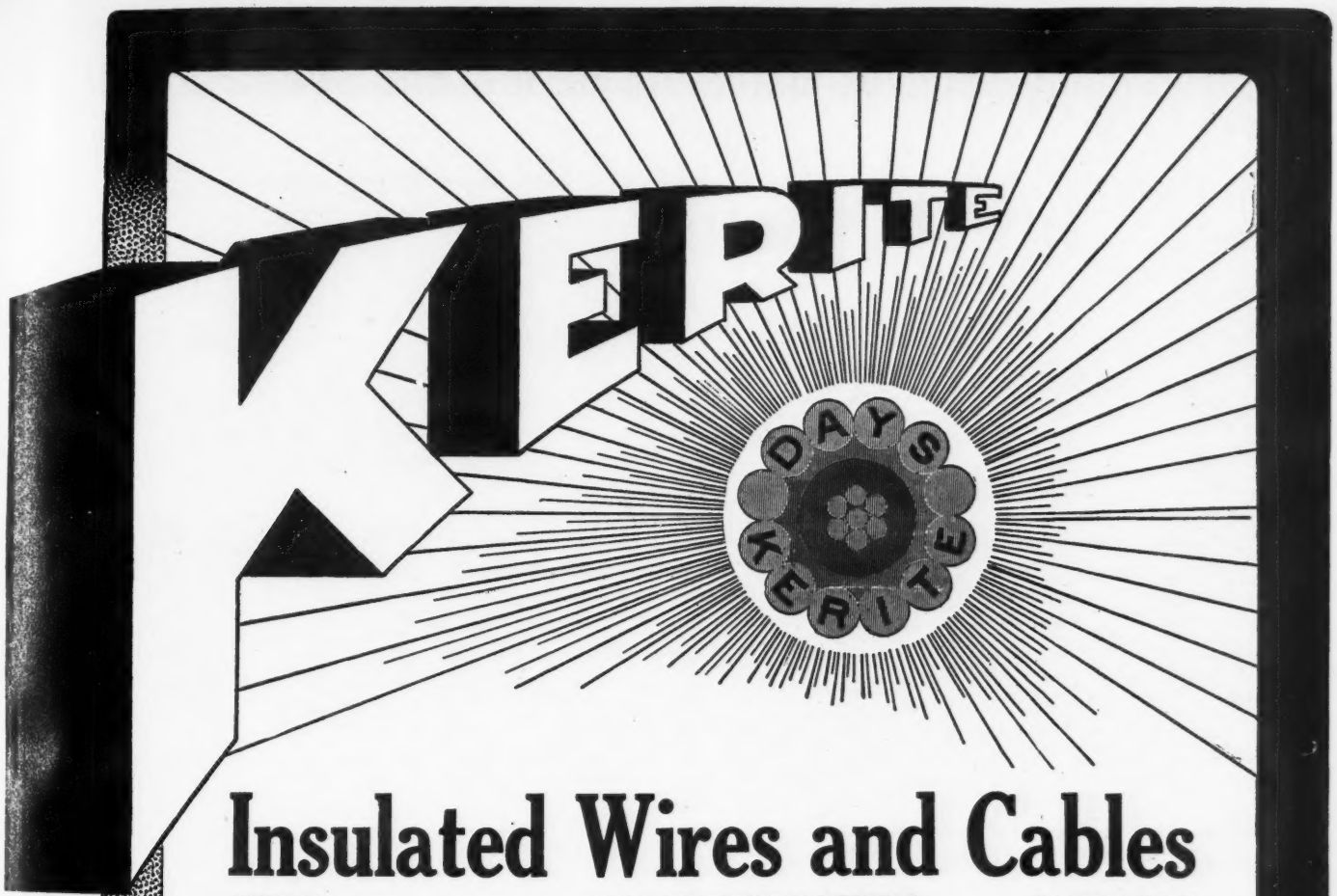


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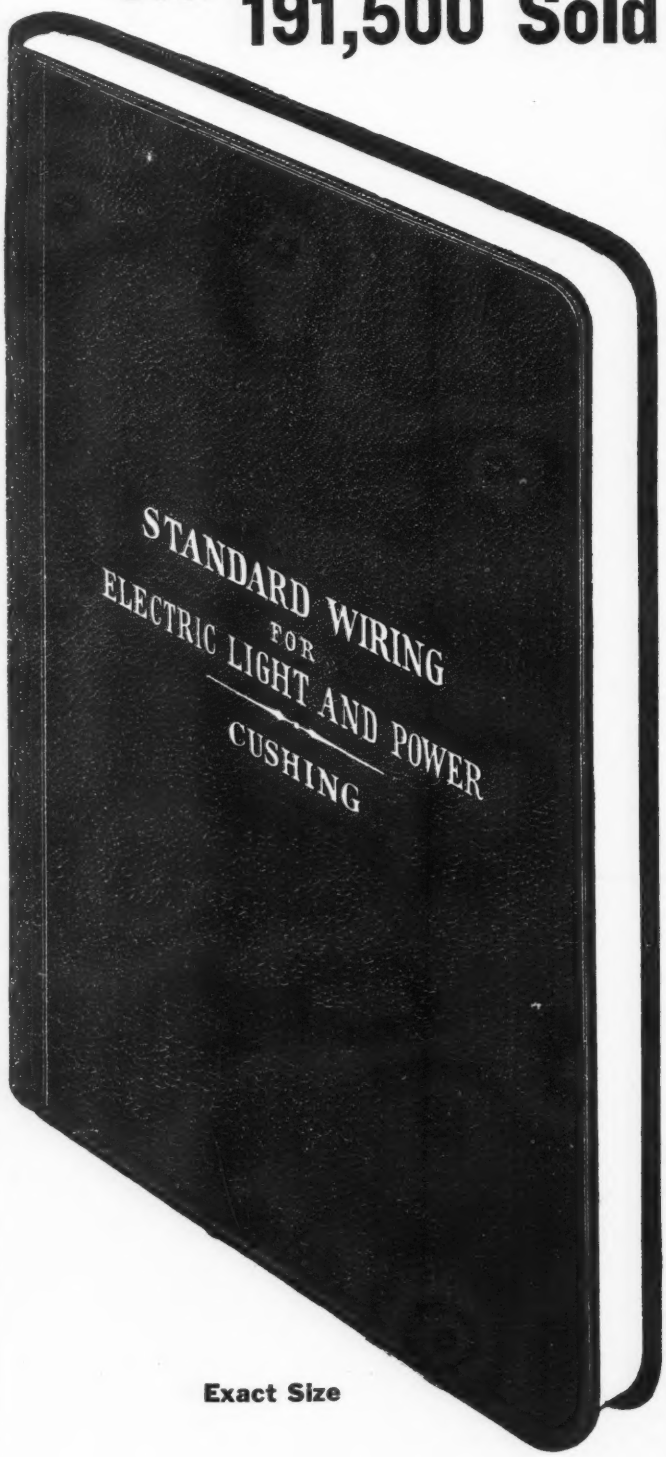


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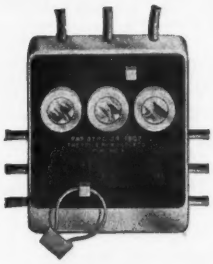

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These covers are used with cleat or moulding services to cover the branch blocks on the line side of the meter. They prevent current theft by making it impossible to tap off from the bare terminals. O. K. Covers are also especially applicable for use on discontinued services as every connection is sealed against unauthorized tampering.

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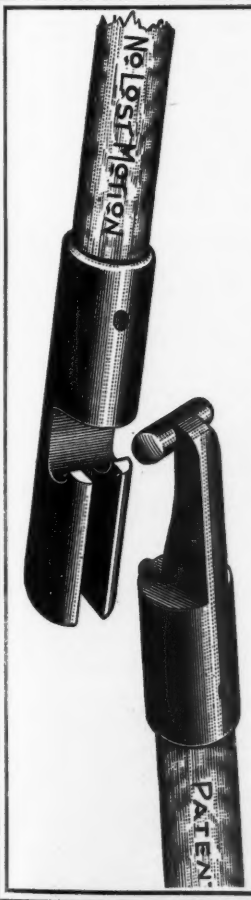


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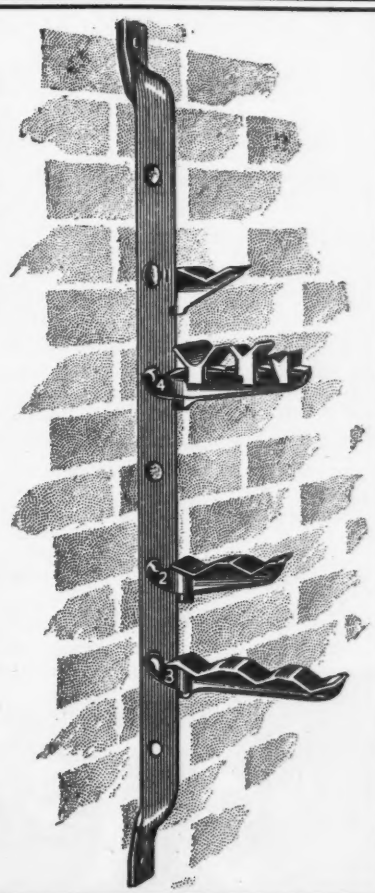

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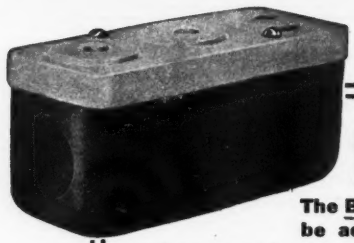

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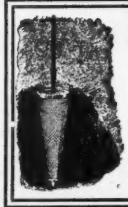

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Back of our proposition is the worth of years of experience in handling electrical conditions.

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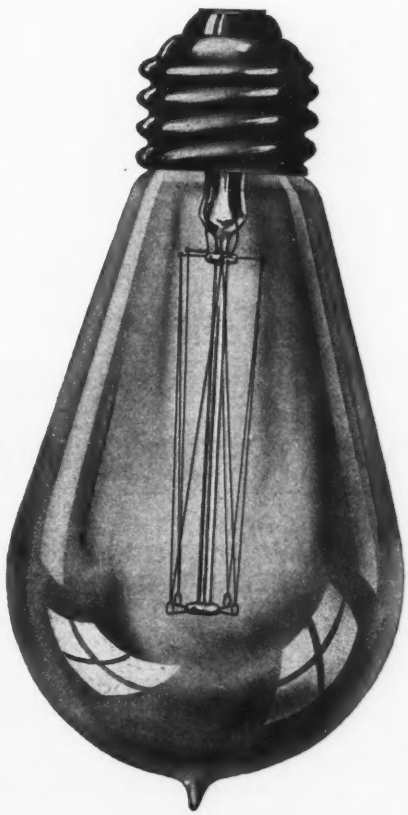

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1 to ¼ Watts per C. P.

We want to increase your business. The profit is one of mutual interest. Your results are also ours.

We can give you great assistance in your selling campaign.

Do you want business and more of it?

Write for details.

BANNER LAMPS

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# A COMPARISON

The ease of stocking and handling Folding Tungstoliers has reduced to a shelf proposition what formerly required warehouses and workshops. The accompanying illustrations need little comment to show the advantages of THE NEW TUNGSTOLIER WAY over the old Fixture Way.

## THE NEW TUNGSTOLIER WAY

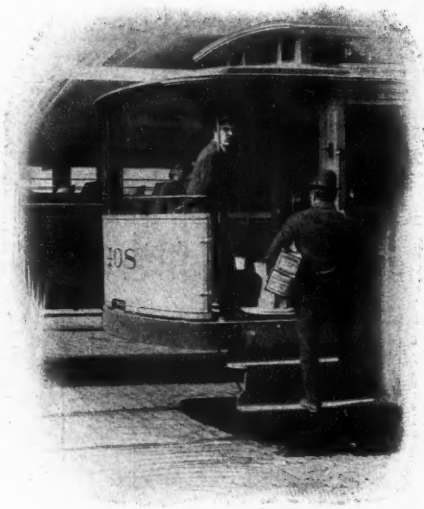
**NO WORKSHOP REQUIRED**

No Stock Pieces or Lost Parts

No Iron Pipe

SHOP LABOR CHARGES **NONE!!**

Cost to deliver on the Job **5 CENTS**



Folding Tungstoliers are shipped in cartons, wired and assembled, ready to install.

## OLD FIXTURE WAY

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Pieces and Parts Needed in Stock

Iron Pipe Fittings

SHOP LABOR CHARGES **?**

COST to DELIVER ON THE JOB **?**

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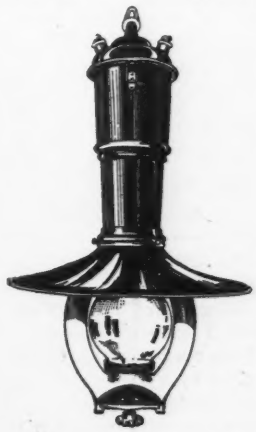
# The Dark Days Are Here

And factories are running over time—everybody wants light.



Flame arcs are the greatest light producers of the age.

The A B Regenerative Flame Arc with 70 hours life on one trim of carbons and other exclusive features is just the lamp for you.

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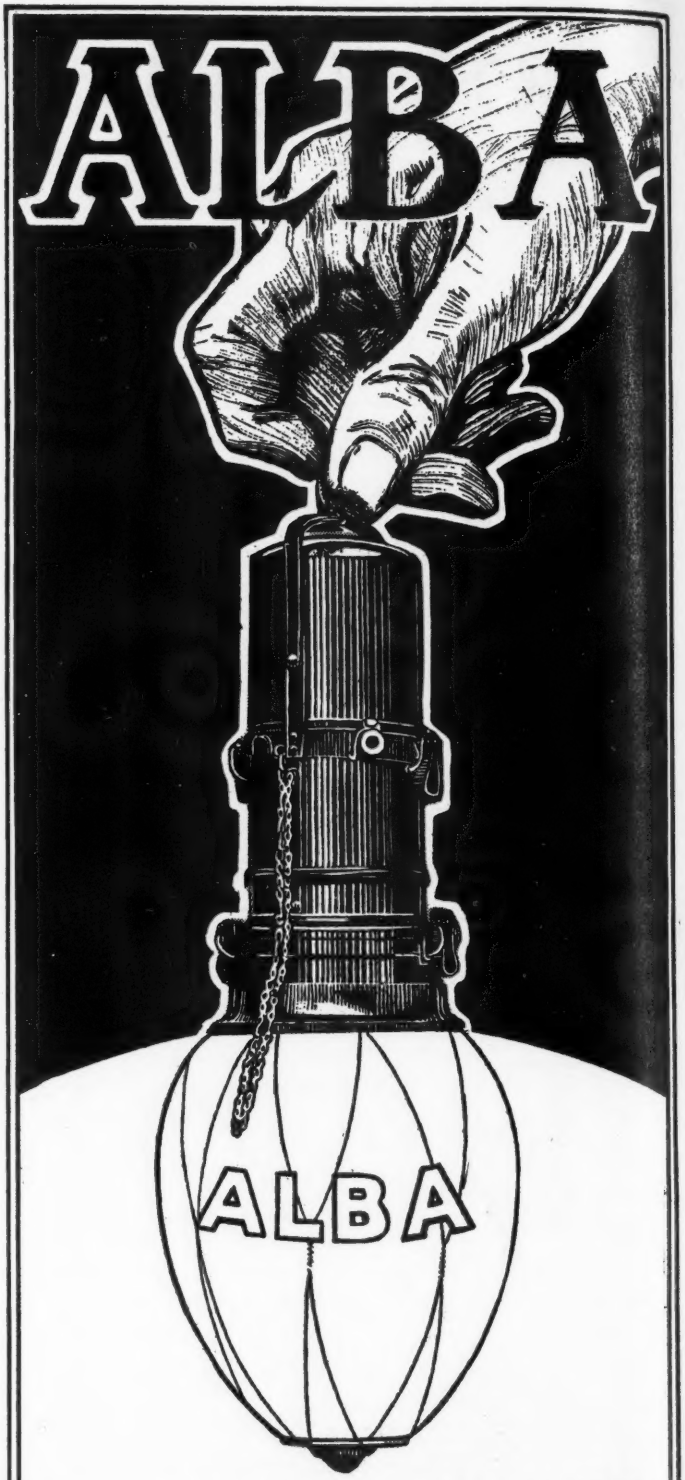


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is the most suitable, because the most efficient, for broad light distribution.

No prismatic glassware needed, as the vertical flame produced by the vertical flame carbons has its maximum intensity under 30 degrees from the horizontal.

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IT may be safely said that the mechanism of the new line of Cutler-Hammer Push-Button Specialties has evoked more enthusiastic commendations from the electrical trade than were ever before called forth by an improvement in switch mechanisms. It is, in fact, the first radical innovation that has been made in years. All other switches are more or less alike in principle and consist of from 30 to 40 separate parts, but here—at last—is something new in principle and so simple in construction that those who have examined it are inclined to believe not only that a great step in advance has been taken, but that the acme of simplicity in switch construction has been reached.

* * *

Imagine a switch mechanism that consists of only three moving parts — a mechanism that is snappy and positive in operation and absolutely new in principle. If you can't imagine it ask us to mail our "silent salesman"—a little working model of this new switch mechanism.

10-ampere porcelain pendant switch

* * *

Bear in mind that in addition to the simple mechanism these switches and sockets possess a number of other advantages:

For one thing, they are made of porcelain—a **non-corrosive** and **non-conductive** material. This means that they will not tarnish like ordinary metal switches and sockets, nor is the user subjected to the risk of accidental shock while handling them, since all current-carrying parts are effectually insulated by the outer covering of porcelain.

6-ampere porcelain pendant switch

* * *

All of these devices are **self-indicating**, the position of the button showing whether the circuit is opened or closed.

Liberal space is provided for knotting the flexible cord and the removal of a single screw gives access to the interior of the switch, facilitating the wiring of these devices.

## PUSH-BUTTON PORCELAIN SPECIALTIES

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**Descriptive Booklet and Price List on Application**

"Revolutionary in its nature."—*Electrical Review.*

"One of the most compact and ingeniously arranged circuit switches that has been produced." *Electrical World.*

The fire glaze used on the porcelain is practically indestructible, while the choice of colors afforded is such that one can select a shade that will harmonize with almost any surroundings. The standard glazes are **Plain White, Ivory Tint, Wood Brown** and **Neutral Gray.** Special glazes can be furnished to order.

Brass cap pendant switch

* * *

Two features of the molding switch are worthy of special mention. These switches are made **exactly the same width as standard molding** and are provided with caps designed to hold a small label. Their size makes it possible to install a number of these switches side by side without leaving space between the lines of molding, while their shape permits the capping to be cut off square instead of having to be whittled out to fit the switch, as in the case of round base switches. When assembled in gangs the label holder provides a place for a word or number indicating the circuit controlled by each switch. For use singly, molding and surface switches without label holders can be furnished.

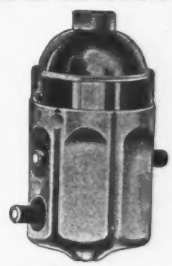
Push button molding switch with label holder

In the case of the lamp socket the substitution of the Push-Button Mechanism for the old-fashioned key commonly used results in a device that is not only more symmetrical in appearance, but which is admirably adapted for use with Tungsten or other lamps possessing a delicate, fragile filament, since the Push-Button Mechanism operates without tilting the lamp out of its normal vertical position or subjecting the filament to sudden jars. This socket has the same working parts as our 6-ampere switches, and therefore opens and closes the circuit with a much quicker and more positive snap than any other socket, besides having a much larger current-carrying and breaking capacity.

Push-button porcelain pendant socket

* * *

In conclusion, particular attention is called to the **two-circuit** pendant switch—the only switch of its kind on the market. A single one of these switches may be used to control two separate circuits in any of the standard clusters, or to control two separate groups of lights, or the switch may be so connected that one push-button controls the lights and the other button some other electrical device—such, for instance, as a fan. Many other applications of this two-circuit switch will readily occur to those familiar with electrical installations.



Two-circuit pendant switch. Porcelain body, brass cap

* * *

Cutler-Hammer Push-Button Specialties can be secured from leading jobbers throughout the country. Descriptive Booklet and Price List mailed on application to the manufacturers.

**THE CUTLER-HAMMER MFG. CO.**
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Pittsburg.....Farmers' Bank Bldg.

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**Complete Meter Testing Outfit for A. C. & D. C. Meters**

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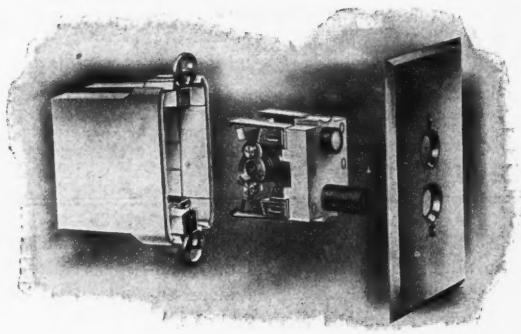

# FIGURE IT OUT

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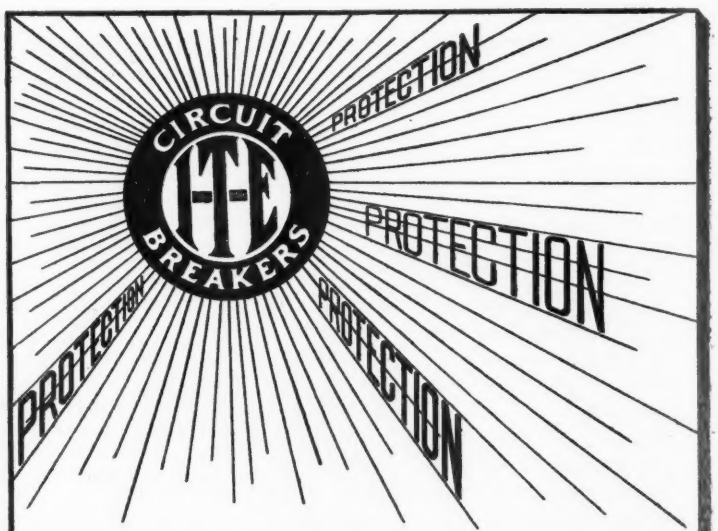


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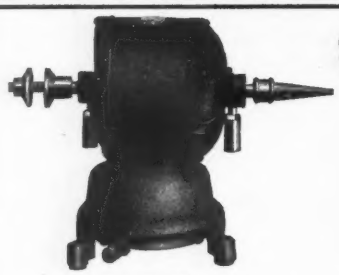

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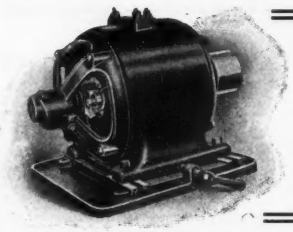

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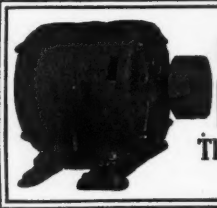

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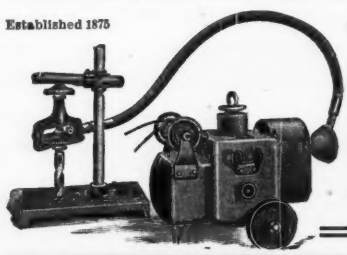

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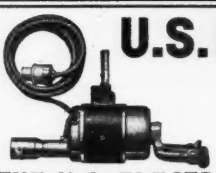

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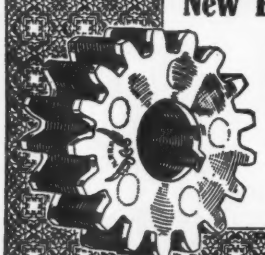

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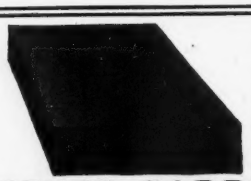

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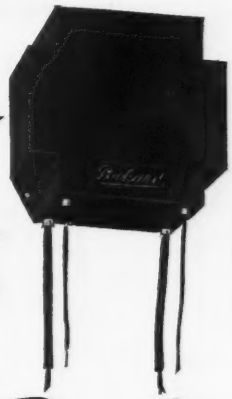

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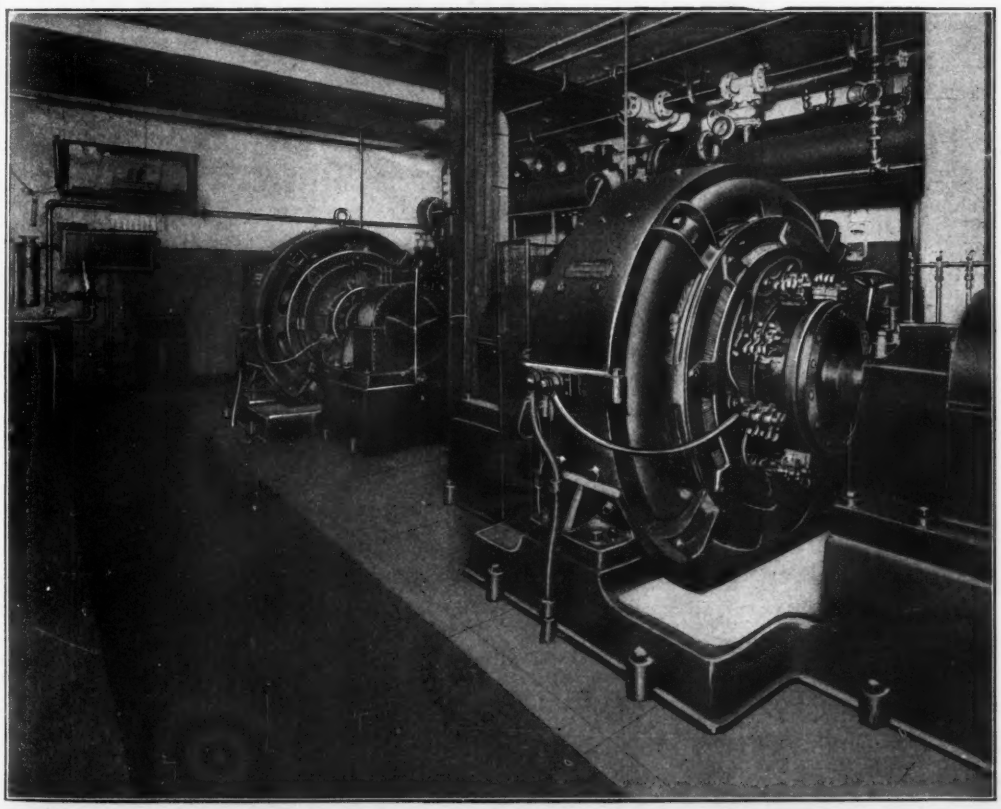

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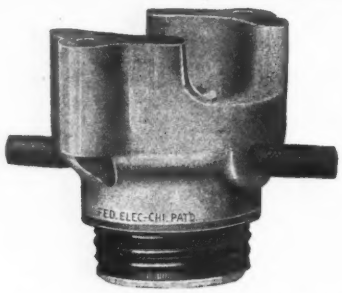

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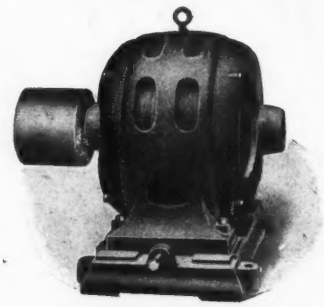

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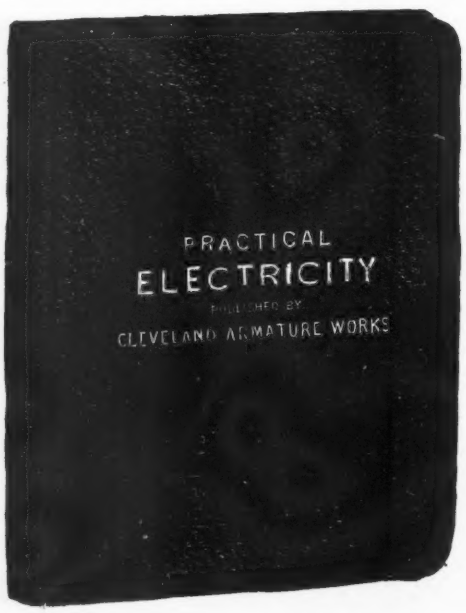


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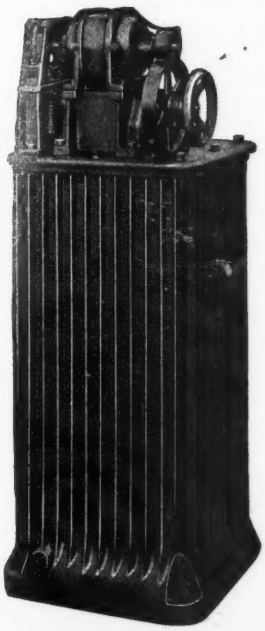
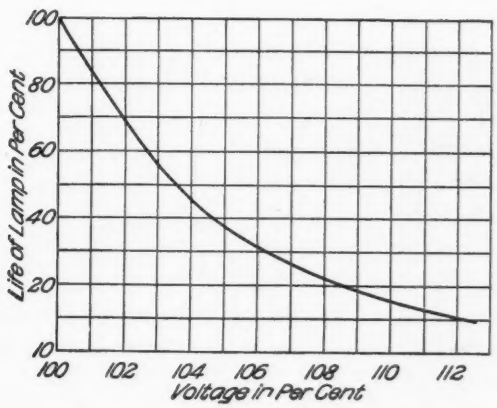
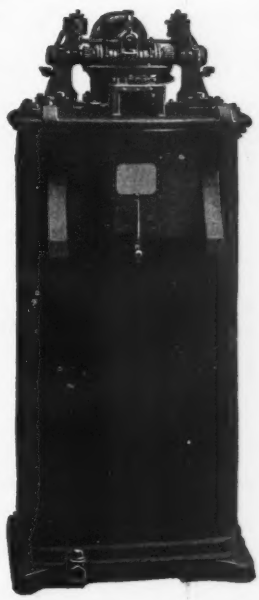


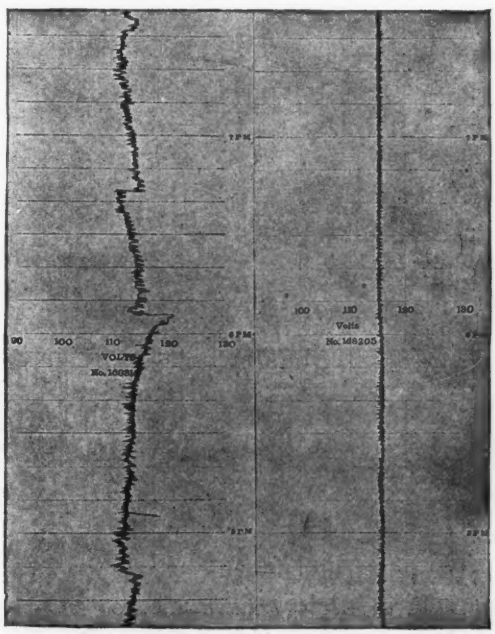
Type IR Feeder Regulator for moderately rapid voltage fluctuations.




Curve showing effect of voltage variation on life of Lamps.



Type BR Feeder Regulator for rapid voltage fluctuations.



Generater Side (Unregulated)

Feeder Side (Regulated)

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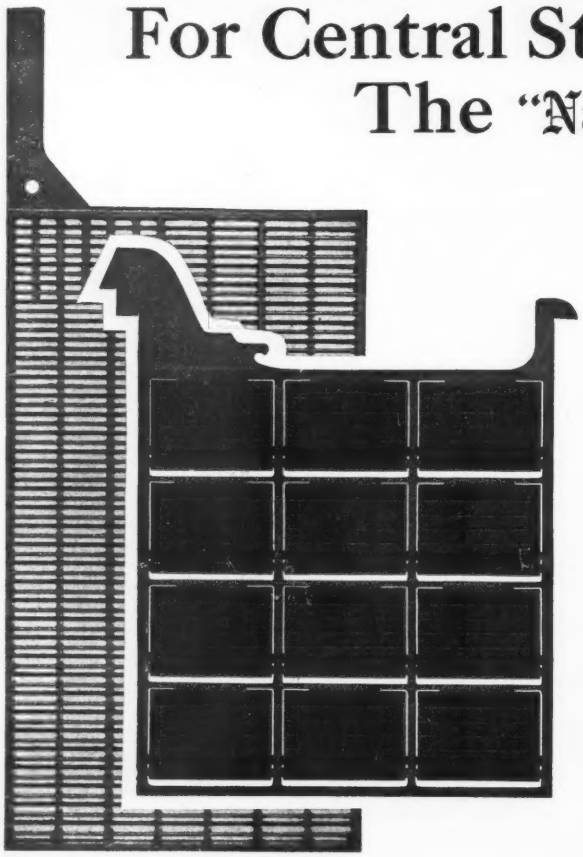

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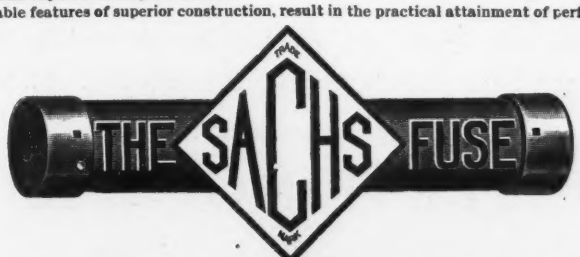


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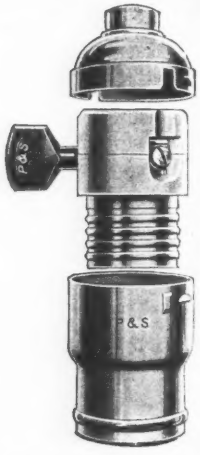


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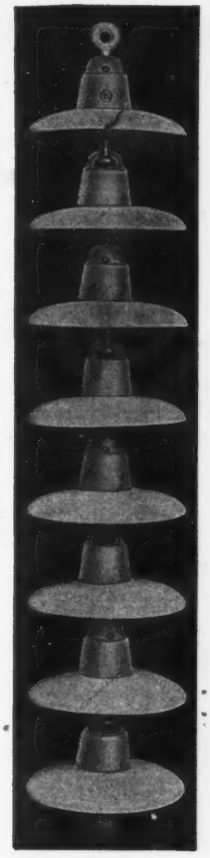

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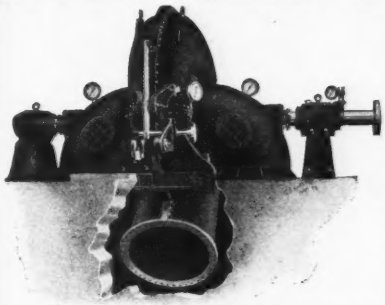

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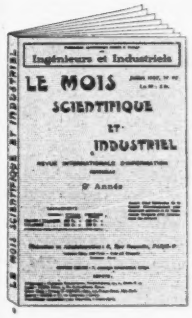


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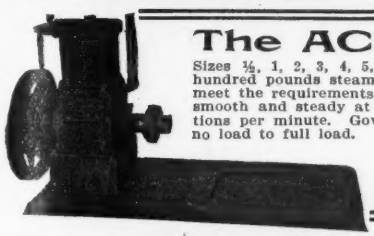

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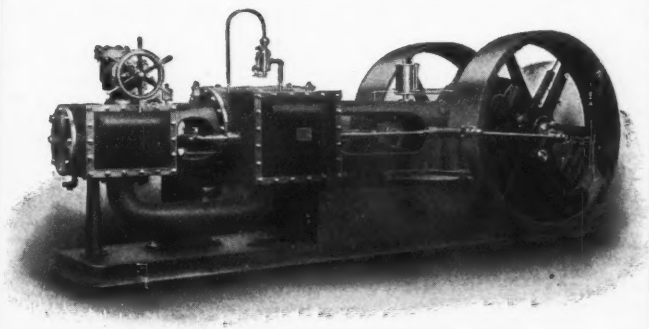

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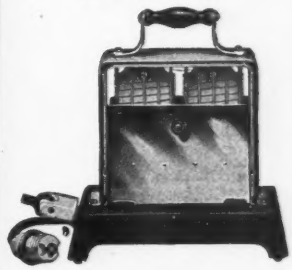

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Central Electric Co.
Electric Goods Mfg. Co.
Goettmann, O. J.
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Partrick, Carter & Wilkins Co.
Stanley & Patterson.
Western Electric Co.

**ARCHITECTURAL ENGINEERS**
Dodge & Day

**ASBESTOS PRODUCTS**
Johns-Manville Co., H. W.

**BATTERIES, PRIMARY**
Bissell Co., The F.
Burnley Battery & Mfg. Co.
Central Electric Co.
Edison Mfg. Co.
Electric Goods Mfg. Co.
Lawrence Electric Co., F. D.
Leclanche Battery Co.
Manhattan Electrical Supply Co.
Western Electric Co.

**BATTERIES, STORAGE**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
United States Light & Heating Co.
Westinghouse Storage Battery Co.
Willard Storage Battery Co.

**BATTERY PLATES**
St. Louis Smelting & Refining Co.

**BELLS**
Central Electric Co.
Electric Goods Mfg. Co.
Goettmann, O. J.
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Partrick, Carter & Wilkins Co.
Western Electric Co.

**BELT DRESSING**
Dixon Crucible Co., Joseph.

**BELTING**
Shultz Belting Co.

**BENDERS, CONDUIT**
Fibre Conduit Co.

**BLOWERS**
Emerson Electric Mfg. Co.

**BOILER-FRONTS AND CASTINGS**
Minneapolis Steel & Machinery Co.

**BOILERS**
Babcock & Wilcox Co., The
Minneapolis Steel & Machy. Co.
Morgan Smith Co., S.
Westinghouse, Church, Kerr & Co.

**BOLTS, EXPANSION, TOGGLE and HANGER**
Star Expansion Bolt Co.
Wrigley Co., Thos.

**BOOKS, TECHNICAL**
Electrical Review Pub. Co.

**BOOSTERS**
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Western Electric Co.

**BOXES, JUNCTION**
Bossert Elect. Const. Co.
Condit Electrical Mfg. Co.

**BOXES, WOOD, CUT-OUT**
Ashland Electric Co.

**BRACKETS**
Western Electric Co.

**BRAKES, ELECTRIC**
Electric Controller and Mfg. Co.

**BRIDGES**
American Bridge Co. of New York

**BRIDLE RINGS**
Bissell Co., The F.
Star Expansion Bolt Co.

**BRUSHES, DYNAMO**
Central Electric Co.
Crown Woven Wire Brush Co.
Dixon Crucible Co., Joseph
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Co.

**BULBS, INCANDESCENT LAMP**
Lippincott Glass Co., The

**BUSHINGS**
Bossert Electric Construction Co.
Condit Electrical Mfg. Co.
Federal Electric Co.
Massachusetts Chemical Co.

**CABINETS**
Lang Electric Co., J.
Taunton-New Bedford Copper Co.

**CABLE DOGS**
Star Expansion Bolt Co.

**CABLE HANGERS**
Bissell Co., The F.
Condit Electric Mfg. Co.
Cope, T. J.
Standard Underground Cable Co.
Star Expansion Bolt Co.
Western Electric Co.

**CABLE TROLLEYS**
Bissell Co., The F.

**CABLING MACHINES**
New England Butt Co.

**CAR HEATERS, ELECTRIC**
Simplex Electric Heating Co.

**CARBONS**
Badt & Co., F. B.
Chicago Carbon Co.
Kiewert Co., Chas. L.
National Carbon Co.
Reisinger, Hugo.
Western Electric Co.

**CARBON BRUSHES**
Central Electric Co.
Speer Carbon Co.
Western Electric Co.

**CASTINGS**
Minneapolis Steel & Machinery Co.
New England Butt Co.
Ohio Brass Co.
Phosphor-Bronze Smelting Co.

**CEMENT, CABLE TRANSFORMER**
Massachusetts Chemical Co.

**CHANDELIERS**
Beardslee Chandelier Mfg. Co.

**CHOKE COILS**
Lord Electric Co.

**CIRCUIT-BREAKERS**
Badt & Co., F. B.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Cutter Electric Mfg. Co.
Electric Controller and Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**CLAMPS, GROUND CONNECTION**
Condit Electrical Mfg. Co.

**CLEATS**
Blake Signal & Mfg. Co.

**CLIMBERS**
Klein & Son, Mathias
Western Electric Co.

**CLUSTERS**
Benjamin Electric Mfg. Co.
Federal Electric Co.
Holophane Co.

**CLUTCHES**
Minneapolis Steel & Machinery Co.

**COAL MINING MACHINERY**
General Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**COILS**
Belden Mfg. Co.
D. & W. Fuse Co.
Western Electric Co.

**COILS, INDUCTION**
Electric Goods Mfg. Co.
Ostrander & Co., W. R.
Roentgen Mfg. Co.
Western Electric Co.

**COILS AND MAGNETS**
Western Electric Co.

**COLORING LAMP**
Lacquer Radiant Co.

**COMMUTATOR LUBRICANT**
Dixon Crucible Co., Joseph
McLennan & Co., K.

**COMPOSITION (MOULDED)**
Pardee, F. W.

**COMPOUNDS, BOILER**
Dearborn Drug & Chem. Wks.
Johns-Manville Co., H. W.

**COMPOUND, INS. AND SPLICING**
Massachusetts Chemical Co.
Standard Paint Co., The
Western Electric Co.

**CONDENSERS, ELECTRIC**
Leeds & Northrup Co.
Marshall, William

**CONDENSERS, STEAM**
Minneapolis Steel & Machinery Co.
Western Electric Co.

**CONDUITS**
American Circular Loom Co.
American Sewer Pipe Co.
Camp Co., H. B.
Clay Product Co.
Clifton Mfg. Co.
Fibre Conduit Co.
Johns-Manville Co., H. W.
McRoy Clay Works.
National Conduit & Cable Co.
National Metal Molding Co.
Sprague Electric Co.

**CONDUIT BENDERS**
Fibre Conduit Co., The

**CONDUIT RODS**
Bissell Co., The F.
Cope, T. J.
Western Electric Co.

**CONDUIT SYSTEMS**
Gest, G. M.

**CONSTRUCTION**
Arnold Co., The
Bates, Putnam A.
Byllesby & Co., H. M.
Central Station Engineering Co.
Dodge & Day
Fergus & Co., W. L.
Kelly Eng. Co., John F.
New England Engineering Co.
White & Co., J. G.

**CONSTRUCTION SUPPLIES**
Bissell Co., The F.
Brady, T. H.
Western Electric Co.

**CONTROLLERS**
Badt & Co., F. B.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Pardee, F. W.
Simplex Electric Heating Co.
Ward Leonard Electric Co.

**CONTROLLER REGULATORS**
Lord Electric Co.

**CONVEYING DEVICES**
Minneapolis Steel & Machinery Co.

**CORD AND ROPE**
American Steel & Wire Co.
Belden Manufacturing Co.
Lowell Ins. Wire Co.
Phosphor-Bronze Smelting Co.
Samson Cordage Works.

**CORRESPONDENCE SCHOOLS**
American School of Correspondence

**COUNTERS, REVOLUTION**
Belden Mfg. Co.

**CRANE MOTORS**
Crocker-Wheeler Co.
General Electric Co.
Western Electric Co.

**CREOSOTED LUMBER**
Western Electric Co.

**CROSS-ARMS, BRACKETS, PINS, CLIMBERS, ETC.**
Bissell Co., The
Brady, T. H.
Central Electric Co.
Kettle River Quarries Co.
Klein & Sons, Mathias
Lindsley Bros. Co., The
Manhattan Elec. Supply Co.
Naugle Pole & Tie Co.
Ohio Brass Co.
Western Electric Co.

**CURRENT TAPS**
Electric Goods Mfg. Co.

**CUSHIONS, FIELD COIL**
Massachusetts Chemical Co.

**CUT-OUTS AND SWITCHES**
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Commonwealth Edison Co.
Cutler-Hammer Mfg. Co.
D. & W. Fuse Co.
Ft. Wayne Elec. Wks.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Trumbull Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**DIMMERS**
Cutler-Hammer Mfg. Co.
Ward-Leonard Electric Co.

**DIRECT MOTOR DRIVE FOR PLANES**
Electric Controller & Mfg. Co., The
Western Electric Co.

**DISCONNECTING SWITCHES**
Lord Electric Co.

**DRILLS**
Star Expansion Bolt Co.
United States Electrical Tool Co.

**DRYING MACHINERY**
Buffalo Foundry & Mach. Co.
Devine Co., J. P.

**DYNAMOS AND MOTORS**
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Commonwealth-Edison Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Manufacturing Co.
Fort Wayne Electric Works.
Garwood Electric Co.
General Electric Co.
Gregory Electric Co.
Guarantee Electric Co.
Peerless Electric Co.
Richmond Electric Co.
Ridgway Dynamo & Engine Co.
Roth Bros. & Co.
Sprague Electric Co.
Stow Mfg. Co.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**ELECTRIC ARC WELDERS**
Electric Controller & Mfg. Co., The

**ELECTRIC COOKING APPARATUS**
American Electrical Heater Co.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.

**ELECTRIC FAULT FINDER**
Electric Controller and Mfg. Co.

**ELECTRIC GAS LIGHTING**
Electric Goods Mfg. Co.

**ELECTRIC IRONS**
American Electrical Heater Co.
Simplex Elec. Heating Co.
Western Electric Co.

**ELECTRIC LIGHTERS**
Stanley & Patterson

**ELECTRIC LOCOMOTIVES**
General Electric Co.
Westinghouse Electric & Mfg. Co.

**ELECTRIC RAILWAYS**
Arnold Co., The
Byllesby & Co., H. M.
Dodge & Day
Fergus & Co., W. L.
General Electric Co.
Hallberg, J. H.
Hammer, Wm. J.
Kelly Eng. Co., John F.
Kitfield, Edw. H.
Knowles, Edw. R.
Mershon, Ralph D.
New England Eng. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
White & Co., J. G.

**ELECTRICAL SUPPLIES**
Bates, Putnam A.
Bissell Co., The F.
Central Electric Co.
Condit Electrical Mfg. Co.

# CLASSIFED INDEX—Continued.

**ELECTRICAL SUPPLIES--Continued**
Commonwealth Edison Co.
Crocker-Wheeler Co.
Electric Goods Mfg. Co.
General Electric Co.
Goettmann, O. J.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Metropolitan Electrical Supply Co.
Ohio Brass Co.
Paiste Co., H. T.
Partrick, Carter & Wilkins Co.
Stanley & Patterson.
Western Electric Co.
Weston Electrical Instrument Co.

**ELECTROMAGNETS**
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**ELECTRO-PLATING MACHINERY**
Crocker-Wheeler Co.
General Electric Co.

**ENGINES, GAS, GASOLINE AND OIL**
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.
Westinghouse Machine Co.

**ENGINES, STEAM**
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.
Ridgway Dynamo & Engine Co.
Rochester Machine Tool Works
Thompson, Jos. H., Jr.
Westinghouse Machine Co.

**ENGINEERS AND CONTRACTORS**
American Bridge Co.
Arnold Co., The
Badt & Co., F. B.
Bates, Putnam A.
Brown, Eugene C.
Byllesby & Co., H. M.
Central Station Engineering Co.
Clement, Edward E.
Cravens, Geo. W.
Dodge & Day
Electro-Mechanical Engineering Co.
Fergus & Co., W. L.
Fowle, Frank F.
Hallberg, J. H.
Hammer, Wm. J.
Humphrey, C. W.
Jackson, D. C. & W. B.
Kelly Engineering Co., John F.
Kitfield, Edward H.
Knowles, Edward R.
Kohler Bros.
Lyndon, Lamar
McMeen, Samuel G.
Marshall, Albert J.
Mershon, Ralph D.
Miller, Kempster B.
New England Engineering Co.
Newgard & Co., Henry
Pillsbury, Chas. A.
Sargent & Lundy
Taylor & Co., J. B.
Western Electric Co.
Western Engineering & Const. Co.
White & Co., J. G.

**FANS AND FAN MOTORS**
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Commonwealth Edison Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Edison Manufacturing Co.
Emerson Electric Manufacturing Co.
Fort Wayne Electric Works.
General Electric Co.
Peerless Electric Co.
Sprague Electric Co.
Stanley & Patterson
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**FAN MOTOR RESISTANCES**
Ward Leonard Electric Co.

**FIBRE**
Fibre Conduit Co.

**FIREPLACE, ELECTRIC**
General Electric Co.

**FITTINGS, ELECTRIC CRANE**
Electric Controller and Mfg. Co.

**FIXTURES, GAS AND ELECTRIC**
Badt & Co., F. B.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Mfg. Co.
Federal Electric Co.
Pardee, F. W.
Tungstoller Co.
Western Electric Co.

**FIXTURE STUDS**
Ashland Electric Co.

**FLASHERS**
Bissell Co., The F.
Haller Sign Works, Inc.
Reynolds Electric Flasher Mfg. Co.
Schneider & Co., C. O.

**FLASHERS, THERMOSTATIC**
Schneider & Co., C. O.

**FLEXIBLE COUPLINGS FOR SHAFTS**
The Electric Controller & Mfg. Co.

**FLAT IRONS, ELECTRIC**
American Electrical Heater Co.
General Electric Co.
Simplex Elec. Heating Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**FLEXIBLE SHAFTS**
Stow Mfg. Co.

**FRICTION TAPES AND CLOTHS**
Johns-Manville Co., H. W.
Massachusetts Chemical Co.
Standard Paint Co.
Western Electric Co.

**FUSES**
Central Elec. Co.
Chicago Fuse Wire & Mfg. Co.
Condit Electrical Mfg. Co.
D. & W. Fuse Co.
Detroit Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Sachs Co., The
Western Electric Co.

**FUSE WIRE**
Chicago Fuse Wire & Mfg. Co.
Condit Electrical Mfg. Co.
General Electric Co.
Western Electric Co.

**GAINS, STEEL**
Belden Mfg. Co.

**GAS PRODUCER POWER PLANTS**
Minneapolis Steel & Machinery Co.
Westinghouse Machine Co.

**GEARS**
New Process Raw Hide Co.

**GENERATORS**
Allis-Chalmers Co.
Crocker-Wheeler Co.
Garwood Electric Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Western Electric Co.

**GLASS TUBINGS**
Lippincott Glass Co., The

**GLOBES, SHADES, ETC.**
Central Electric Co.
Fostoria Glass Specialty Co.
Holophane Co.
Lippincott Glass Co., The
Phoenix Glass Co.
Western Electric Co.

**GRAPHITE**
Dixon Crucible Co., Joseph
Holmes Fibre Graphite Co.

**GRINDERS, ELECTRIC, (Center)**
United States Electrical Tool Co.

**GRINDERS, ELECTRIC, (Surface)**
United States Electrical Tool Co.

**GROUND CONES**
Pardee, F. W.

**GROUND CONNECTION CLAMPS**
Condit Electrical Mfg. Co.
Western Electric Co.

**HAND DRILLS, ELECTRIC**
United States Electrical Tool Co.

**HANGERS, CONDUIT AND MOULDING**
Condit Electrical Mfg. Co.
Western Electric Co.

**HEATING APPARATUS**
American Electrical Heater Co.
General Electric Co.
Johns-Manville Co., H. W.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Western Electric Co.

**HEATING (EXHAUST STEAM)**
American District Steam Co.

**HOISTING MACHINERY**
Allis-Chalmers Co.

**HYDRAULIC MACHINERY**
Allis-Chalmers Co.

**IMPREGNATING APPARATUS**
Buffalo Foundry & Machine Co.
Devine & Co., J. P.

**INNER GLOBES**
Fostoria Glass Specialty Co.
Phoenix Glass Co.
Western Electric Co.

**INSTRUMENTS**
Badt & Co., F. B.
Bristol Co.
Columbia Meter Co.
Cutter Electrical Mfg. Co.
Duncan Electric Mfg. Co.
Esterline Co.
Fort Wayne Electric Works
General Electric Co.
Hoyt Electrical Instrument Works
Johns-Manville Co., H. W.
Keystone Electrical Instrument Co.
Leeds & Northrup Co.
Pignolet, Louis M.
Sangamo Electric Co.
Wagner Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.
Weston Electrical Instrument Co.

**INSULATING CEMENTS**
Bowdlear Co., W. H.
Massachusetts Chemical Co.

**INSULATING COMPOUNDS**
Bowdlear Co., W. H.
Electric Cable Co.
General Electric Co.
Massachusetts Chemical Co.
Mineralac Electric Co.
Ohio Brass Co.
Western Electric Co.

**INSULATING MACHINERY**
New England Butt Co.

**INSULATING PAINTS**
Massachusetts Chemical Co.
Standard Paint Co.

**INSULATORS AND INSULATING MATERIAL**
American Electrical Works
Brixey, W. R.
Brookfield Glass Co.
Central Electric Co.
Commonwealth Edison Co.
Detroit Insulated Wire Co.
General Electric Co.
Hemingray Glass Co.
Indiana Rubber & Insulated Wire Co.
Johns-Manville Co., H. W.
Massachusetts Chemical Co.
Mica Insulator Co.
Mineralac Electric Co.
Munsell & Co., Eugene
New York Insulated Wire Co.
Okonite Co.
Ohio Brass Co.
Packard Electric Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**IRIDIO PLATINUM, WIRE AND SHEET**
Baker & Co., Inc.

**IRONS, ELECTRIC**
American Electrical Heater Co.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**JOINTS, WIRE**
Western Electric Co.

**JUNCTION BOXES**
Bossert Electric Construction Co.
D. & W. Fuse Co.
Western Electric Co.

**LAMP ADJUSTERS, INCANDESCENT**
Edgerton, E. E.
Illinois Appliance Co.

**LAMP COLORING AND FROSTING**
Lacquer Radiant Co.

**LAMP-MAKING MACHINERY**
Dwyer Machine Co.

**LAMPS, ARC**
Adams-Bagnall Electric Co.
Badt & Co., F. B.
Bissell Co., The F.
Central Electric Co.
Excello Arc Lamp Co.
Fort Wayne Electric Works
General Electric Co.
Klewert Co., Chas. L.
Sunray Electric Lamp Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**LAMPS, DECORATIVE**
Central Electric Co.
General Electric Co.

**LAMPS, INCANDESCENT**
Badt & Co., F. B.
Banner Electric Co.
Boston Incandescent Lamp Co.
Brilliant Electric Co.
Bryan-Marsh Co.
Buckeye Electric Co.

**LAMPS, INCANDESCENT**
Central Electric Co.
Columbia Incandescent Lamp Co.
Colonial Electric Co.
Commonwealth Edison Co.
Economical Elec. Lamp Co.
Economy Electric Co.
Fort Wayne Electric Works
Fostoria Incandescent Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
Goettmann, O. J.
Guarantee Electric Co.
Johns-Manville Co., H. W.
Liberty Electric Mfg. Co.
Nernst Lamp Co.
New York & Ohio Co.
Novelty Incandescent Lamp Co.
Safety Electric Co.
Sterling Electrical Mfg. Co.
Warren Electric & Specialty Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Westinghouse Lamp Co.

**LAMPS, MERCURY-VAPOR**
Cooper-Hewitt Electric Co.

**LAMPS, VACUUM TUBE**
Moore Electrical Co.

**LIFTING MAGNETS**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Western Electric Co.

**LIGHTING PLANTS**
Allis-Chalmers Co.
Crocker-Wheeler Co.
Fort Wayne Electric Works
General Electric Co.
Stanley & Patterson
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**LIGHTNING ARRESTERS**
D. & W. Fuse Co.
General Electric Co.
Lord Electric Co.
National Electric Specialty Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**LINE MATERIAL**
Bissell Co., The F.
General Electric Co.
Johns-Manville Co., H. W.
Klein & Sons, Mathias
Ohio Brass Co.
Western Electric Co.

**LOCOMOTIVES, ELECTRIC**
General Electric Co.

**LUBRICANTS**
Dearborn Drug & Chem. Works
International Acheson Graphite Co.

**MACHINE TOOLS AND MACHINERY**
New England Butt Co.

**MACHINES, WIRE MEASURING**
Minneapolis Elec. & Construction Co.

**MAGNETS**
Esterline Co.
D. & W. Fuse Co.

**MAGNET WIRES**
(See Wires and Cables)

**MAGNETIC SOLENOIDS**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.,

**MAGNETIC SWITCH CONTROLLERS FOR LARGE MOTORS**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.,

**MAST-ARMS**
Bissell Co., The F.
Brady, T. H.

**METALS**
Baker & Co., Inc.
Phosphor-Bronze Smelting Co.

**METERS**
Central Laboratory Supply Co.
Columbia Meter Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Johns-Manville Co., H. W.
Pignolet, L. M.
Sangamo Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

**MICA**
Mica Ins. Co.
Munsell & Co., Eugene

**MINING MACHINERY**
Allis-Chalmers Co.

**MOTORS**
(See Dynamos & Motors)

**MOULDING**
Fancleve Specialty Co.

**NAME PLATES**
Schwerdtle Stamp Co., The

# CLASSIFIED INDEX—Continued.

**OUTLET BOXES AND COVERS**
Bossert Electric Construction Co.
Condit Electrical Mfg. Co.
Chicago Fuse Wire & Mfg. Co.
Western Electric Co.

**OUTLET BOX RECEPTACLES**
Benjamin Electric Mfg. Co.
Western Electric Co.

**PAINTS, INSULATING**
Dixon Crucible Co., Joseph
Massachusetts Chemical Co.
Standard Paint Co.
Western Electric Co.

**PANEL-BOARDS**
General Electric Co.
Taunton-New Bedford Copper Co.
Trumbull Electric Mfg. Co.
Western Electric Co.

**PATENT SOLICITORS**
Bain, Foree
Clement, Edward E.
Duvall, Edw. S.
Siggers & Siggers

**PHOSPHOR-BRONZE**
Phosphor-Bronze Smelting Co.

**PHOTOMETER**
Dwyer Machine Co.

**PHOTOMETER STANDARDS**
Electrical Testing Laboratories

**PIGTAILS, CARBON BRUSH**
Belden Mfg. Co.

**PINIONS**
New Process Rawhide Co.

**PLATINUM PRODUCTS**
American Platinum Works
Baker & Co., Inc.

**PLATINUM WIRE AND SHEET, PLATINUM CRUCIBLES AND DISHES, PLATINUM RIVETS**
American Platinum Works
Baker & Co., Inc.

**PLUGS, ATTACHMENT**
Electric Goods Mfg. Co.
Electro-Ad Co.
General Electric Co.
Western Electric Co.

**PLUGS, FUSE**
General Electric Co.
Pass & Seymour, Inc.
Western Electric Co.

**POLES, BRACKETS, PINS, TIES, CROSS-ARMS, CLIMBERS, ETC.**
Bissell Co., The F.
Brady, T. H.
Coolidge-Schussler Co.
Crawford Cedar Co.
Duluth Log Co.
Franklin Steel Co.
Johns-Manville Co., H. W.
Kellogg Switchboard & Sup. Co.
Kettle River Quarries Co.
Klein & Sons, Mathias
Lindsley Bros. Co., The
National Pole Co.
Naugle Pole & Tie Co.
Pacific Coast Pole Co.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
Wittenberg Cedar Co.
Worcester Co., C. H.

**POLES AND BRACKETS, METAL**
Morris Co., Elmer P.

**POLE STEPS**
American Steel and Wire Co.

**POTENTIOMETERS**
Leeds & Northrup Co.

**PUMPING MACHINERY**
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.

**PUSH-BUTTONS**
Cutler-Hammer Mfg. Co.
Electric Goods Mfg. Co.
Manhattan Electrical Supply Co.
Partrick, Carter & Wilkins Co.
Ward Leonard Electric Co.
Western Electric Co.

**RADIAL DRILLS, ELECTRIC**
United States Electrical Tool Co.

**RAIL BONDS**
Condit Electrical Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Lord Electric Co.
Ohio Brass Co.
Roebling's Sons Co., John A.
Western Electric Co.

**RAIL JOINTS**
Rail Joint Co.
Western Electric Co.

**RAILWAY SPECIALTIES, ELECTRIC**
Blake Signal & Mfg. Co.
Central Electric Co.
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Rail Joint Co., The
Western Electric Co.
Westinghouse Electric & Mfg. Co.

**REFLECTORS**
Frink, I. P.
Holophane Co.
National X-Ray Reflector Co.
Phoenix Glass Co.
Wheeler Reflector Co.

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## Mr. Howard M. Post, of the Western Electric Company, has the following to say on the subject of advertising, addressed to the salesmen of his company, in the December number of ADVERTISING & SELLING:

Now just a few words about the "reenforcing" sales force we are employing.

We mean our advertising.

We want you to fully realize how it will help you to make more sales --- and to know how to make the greatest use of this selling cooperation.

Our advertising will do a big share of your "advance" work---the "missionary" work. It will "drum up" prospects. It will create widespread interest in our goods.

It will introduce **you** and your goods---get an **audience** for you---an attentive **hearing.**

All of which is important preliminary sales work, which **without** our advertising, you would have to do yourself. So you see that by doing much of this time-taking advance work, our advertising gives you more time for the **closing** work in **making sales---and makes your closing work easier.**

That our advertising **is** "working", in cooperation with you and every one of our salesmen, is evidenced right along by the large number of inquiries we are receiving, and when we refer one of these inquiries to you, you can **know** you have a **live** prospect---that your man is already **keenly** interested.

Looking at this advertising proposition strictly from **your** point of view:

Suppose you have just made up your mind to take an agency for our machines. Which would you take---a line you had never heard of, or a line with a name **you** know and **everybody** knows?

You wouldn't argue that question a minute. You'd take the well-known line. Why?

Because it would be a whole lot easier to sell. If your prospective customer knows only the **name** of the make of machines you represent, you know your sale is **half made.** You can dispense with preliminaries and get right down to business.

You bank on his favorable consideration right from the start. You don't have to tell him your machines are as good as something he knows about, simply because your line has been introduced to him. That is the beginning of his prejudice in favor of it. But where did he get the introduction?

**From our advertisements.**

He may not know how he got it himself. Maybe it is just a case of the name meeting his eye from time to time until it has made a **dent** in his consciousness. But the advertisement starts the sale for you.

We are convinced that the right kind of advertising to the right kind of people gets results for you and us.

If it didn't help you, it wouldn't help us.

You see we are in partnership on this thing.

**The above is just what a wise, up-to-date sales manager would say to his salesmen. It is worth the consideration of every advertiser and non-advertiser. It is the truth, ably and strikingly told, about the benefits of intelligent advertising.**

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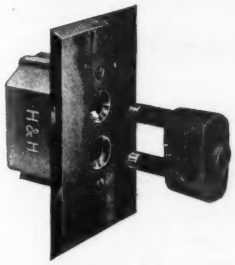


Receptacles with exposed contacts are subject, because of nearness to floor, to being clogged up with dust and sweepings, and are frequently short-circuited by young children. Apertures in face-plate of the "H & H" Receptacle are tightly and automatically closed upon withdrawal of plug, and contacts are thus rendered dust-proof and child-proof.

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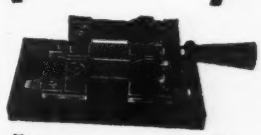

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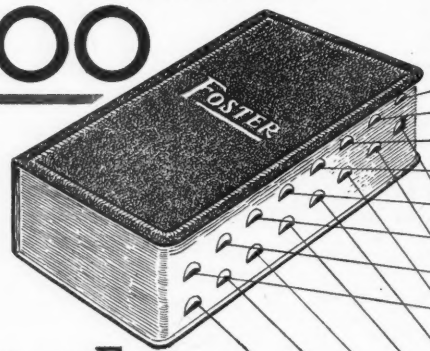


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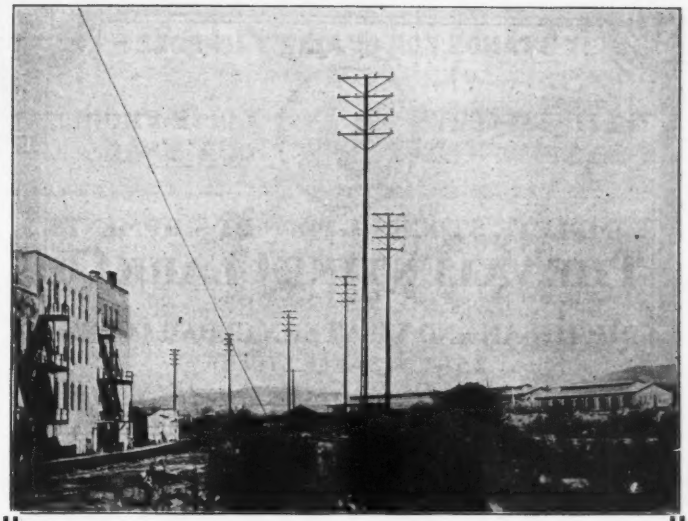

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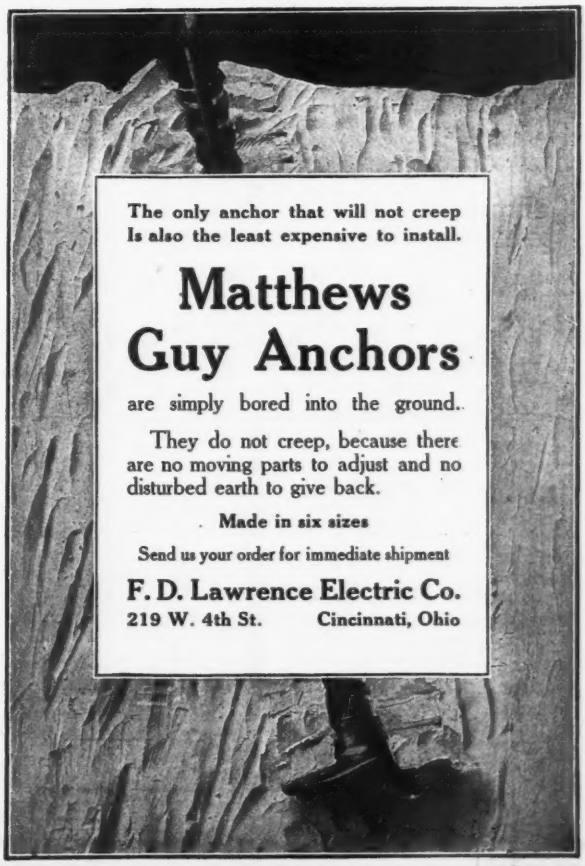

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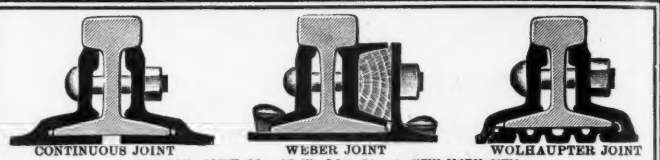

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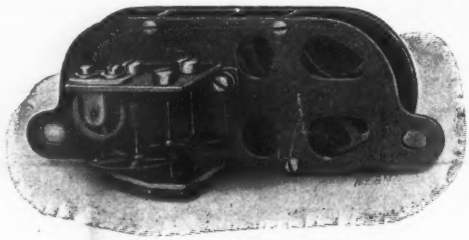

Type "C" Wattmeter Registering Mechanism

Type "C" Wattmeter with Metal Case

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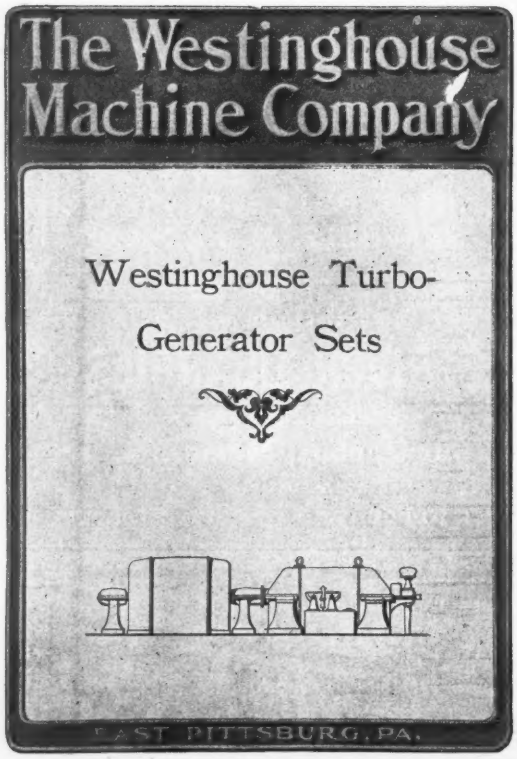


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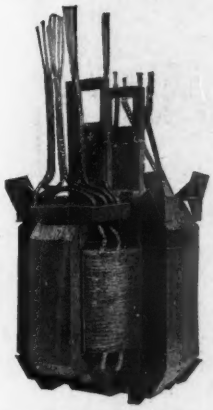
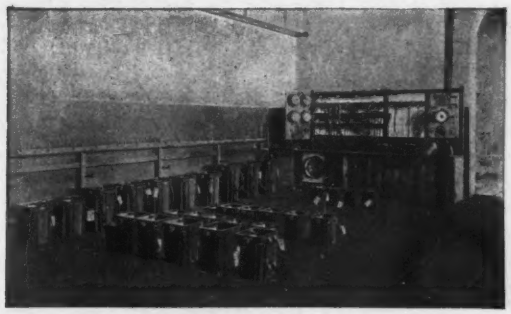
## Type "S" Transformers



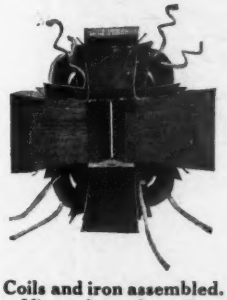
Type "S" Transformer partially assembled, showing top and bottom end plates



Corner in the Westinghouse Type "S" Transformer Testing Department, showing one of the testing tables

Type "S" Transformer in case

## Inspecting and Testing



Coils and iron assembled. View through coils showing oil circulating ducts

Magnetic circuit

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